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THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
SECTION A—MATHEMATICS AND ASTRONOMY

THE joint sessions of Sections A and D and the Chicago Section of the American Mathematical Society constituted a most inspiring and far-reaching feature of the meetings of this section. A separate report of these sessions will appear in SCIENCE. The address of the retiring vice-president, Professor Edward Kasner, of Columbia University, was read before a joint meeting of this section and the Chicago Section of the American Mathematical Society. It was entitled "Geometry and Mechanics," and will appear in a later number of SCIENCE. The following twenty-seven papers were read at the separate meetings of Section A.

1. *Observations with the Bruce Spectrograph:* EDWIN B. FROST.
2. *Comments on the Zeiss Stereocomparator and the Spectrocomparator belonging to Yerkes Observatory:* EDWIN B. FROST.
3. *Photographic Phenomena of Comet d 1907 (Daniel):* E. E. BARNARD.
4. *On a Great Bed of Nebulosity in Sagittarius, photographed with the Bruce Telescope of the Yerkes Observatory:* E. E. BARNARD.
5. *Note on the Problem of Three Bodies:* E. O. LOVETT.
6. *The Light Curve of Delta Cephei:* JOEL STEBBINS.
7. *An Application of the Selenium Cell to Astronomical Photometry:* JOEL STEBBINS and F. C. BROWN.
8. *Observations and Explanation of the Phenomena seen at the Disappearances of the Rings of Saturn:* E. E. BARNARD.
9. *On the Twenty-foot Horizontal Solar Spectro-*

graph of the Yerkes Observatory: EDWIN B. FROST and PHILIP FOX.

10. *A Graphic Method for the Determination of the Orbit of a Spectroscopic Binary:* KURT LAVES.
11. *New Tables for the Time of Sight Correction of the Earth's Orbital Motion:* KURT LAVES.
12. *A Generalized Theory of Integral Equations:* W. D. CAIRNS.
13. *On the Theory of Order, Static and Nascent:* G. B. HALSTED.
14. *Singular Points in the Approximate Development of the Perturbative Function:* F. W. REED.
15. *On a Certain Class of Algebraic Translation-surfaces:* JOHN EISLAND.
16. *Matrices not belonging to Groups:* ARTHUR RANUM.
17. *A Note on Interest on Reserve from Items Computed for the Uniform Report Blank:* C. H. BECKETT.
18. *On Asymptotic Isothermic Surfaces:* A. E. YOUNG.
19. *Some Questionable Terms and Definitions used in Elementary Mathematics:* G. A. MILLER.
20. *The Photographic Determination of Star-colors and their Relation to Spectral Type:* J. A. PARKHURST and F. C. JORDAN.
21. *On the Detection of the Eruptive Prominences on the Solar Disk:* PHILIP FOX.
22. *An Investigation of the 40-inch Objective at the Yerkes Observatory:* PHILIP FOX.
23. *The Function of a Color Filter and of Certain Plates in Astronomical Photography:* R. J. WALLACE.
24. *The Vertical Cœlostat or "Tower" Telescope of the Mt. Wilson Solar Observatory:* G. E. HALE.
25. *Preliminary Results of a Comparative Study of the Spectra of the Limb and the Center of the Sun:* G. E. HALE and W. S. ADAMS.
26. *A Simple Method for Reducing Spectrograms:* FRANK SCHLESINGER.
27. *On the Probability of the Near Approach of Two Stars and on Relative Problems in the Sidereal Universe:* F. R. MOULTON.

In the absence of their respective authors the papers of Doctors Cairns, Halsted, Lovett and Ranum were read by title, and the paper by Professor Schlesinger was read by Mr. Fox. All the other papers in the above list were read by their authors, and the abstracts which follow bear numbers corresponding to those of the titles in this list.

1. These observations refer to recent work at the Yerkes Observatory on stars having interesting spectra and include some new spectroscopic binaries.

2. In this second paper by Professor Frost he described the satisfactory experience with the instruments mentioned in the title. Although they have been in use for only a few months, their merits appear fully established.

3. This comet became a large one, visible to the naked eye in July and August. With the eye alone, the maximum length of the tail was about 17°, but the photographs showed that it really attained a length of some 25°.

The comet was photographed on every possible occasion with the Bruce photographic telescope of the Yerkes Observatory. Though these pictures showed very rapid changes in the form and general structure of the tail, they did not reveal any new phenomena.

The most interesting feature was a large mass of cometary matter that was thrown off from the head about July 11. Photographs made of the comet by M. Quenessett in France, by the writer at the Yerkes Observatory and by Mr. Duncan at the Lick Observatory on that date showed that this mass, though it was left behind by the comet, partook of its sunward motion, for it drifted slowly towards the sun throughout the period covered by the photographs. Professor Barnard exhibited a number of lantern slides which showed the changes in the tail.

4. In his second paper Professor Barnard gives new nebulous stars and nebulosities shown on photographs made by him in the pure atmosphere of Mt. Wilson in the summer of 1905. He also showed that nebulæ M 17, M 16 and M 8 have wide extensions of feeble nebulosity that greatly

increase their previously known sizes, and he located and described nebulous regions situated in the constellation Sagittarius.

5. In this paper Professor Lovett constructs a problem of three bodies possessing exact transcendental solutions defined by finite equations; these solutions reduce to the Lagrangian solutions of the classic problem of three bodies when the ideal problem assumes the Newtonian form. The paper is a part of an extended memoir which is not ready yet for publication.

6. Professor Stebbins gives the results of a long series of photometric observations of the well-known variable star Delta Cephei. The measures were made with a polarizing photometer attached to a twelve-inch refractor. On each night 96 comparisons of the variable and companion star were taken, the entire series comprising more than 7,000 settings. The observations were combined by the method of overlapping means, and the resulting light curve shows two secondary fluctuations in addition to the main variation in brightness. No complete determination of the variation in radial velocity has been made for this star, and new measures with a modern spectrograph would throw some light upon the conditions that exist in this interesting system.

7. The authors connected a selenium cell as one arm of the ordinary Wheatstone bridge, and an exposure of the cell to light decreased its resistance and caused a deflection of the galvanometer. One observer would point the cell at the moon and make an exposure of ten seconds, while the other observer, situated in a separate room with the remainder of the apparatus, would read the galvanometer. From a series of additional exposures on a standard candle at different distances, the moon's light was determined in terms of candle power at 1 meter. A curve of the variation of moonlight with phase was shown, and from this was derived that the full moon is approximately nine times as bright as the half moon. It was also found that the moon is brighter between first quarter and full than in the corresponding phase after full moon.

Different cells gave discordant values for the candle power of the moon, and it was shown that this must be due to the different color sensibilities of the cells. The relative sensibility for different wavelengths was determined for each cell, and it was found that no two of the cells had the same color curve. In all cases there is a maximum at about λ 7,000, but the two Giltay cells have each another maximum near λ 6,000. It was therefore concluded that selenium cells differ much as do photographic plates as regards color sensibility.

For measures of starlight a special small cell was obtained from Giltay, and by placing this cell in the focus of a 12-inch refractor, it was possible to obtain galvanometer deflections caused by the light from bright stars. Some results of the first night were given, the scale being 5 meters from the galvanometer, and the deflections as follows:

Star	Magnitude	Deflection
Mars		9.0 m.m.
α Tauri	1.0	3.4
α Arietis	2.1	1.3
β Arietis	2.8	0.8
γ Arietis	4.0	visible

These measures were made with a galvanometer which is not very sensitive, and it is hoped that the accuracy of the observations will be considerably increased when a new and more sensitive galvanometer is obtained. If it becomes possible to eliminate the effect of several disturbing factors, especially that of temperature change, there is no doubt that accurate measures of starlight can be made with selenium cells.

8. In July, October and November when there was no direct sunlight shining on the ring the entire ring was distinctly visible with the 40-inch telescope of the Yerkes Observatory.

On July 2 there were two luminous conspicuous masses or condensations visible on the ansæ, both preceding and following. As the visible surface of the ring and the condensations were on the shadow side of the ring where no direct sunlight could fall, the natural conclusion would be that the rings must be self-luminous. But this, from the nature of the constitution of the rings, is shown to be impossible.

The explanation given for this phenomenon is that the sunlight sifts through among the particles composing the rings, and by diffusion, or scattering and reflection, the dark side becomes luminous. Micrometer measures show that the condensations fall on the bright outer portion of the inner bright ring and on its projection near the planet. It is believed that the greater density of this part of the ring makes it more luminous when seen from underneath—just as it appears when the direct sunlight falls on it. In reality what we have seen, therefore, is the surface of the ring seen at a very oblique angle, where it is less than 1″ of arc in width, illuminated by the sunlight percolating through the rings, similar to the sunlit view that we get of the rings, but far more feebly illuminated. That these bright places are not real elevations above the surface of the ring is shown by the fact that they disappeared when the edge of the ring was toward us, at which time they should have been better seen if they were masses on the ring. The eye was simply deceived by their greater brightness, which gave them the appearance of being masses on the ring.

9. Professor Frost gave a description of a solar spectrograph recently mounted in the Snow building of the Yerkes Observatory and explained some preliminary results obtained by means of this instrument.

10. The new method here presented by Professor Laves rests on the geometric properties of the hodographic circle. It shows that from the observed maximum and minimum velocities we can determine K and $Ke \cos \omega$ where K is the radius of the hodographic circle, e the eccentricity of the orbit and ω the longitude of the periastron. By Schwarzschild's proceeding the time of periastron-passage is determined from the course of velocities. The velocity at periastron derived from the same curve furnishes two points in the hodograph of which the one of the two is the periastron. The diameter through this point cuts the chord of central distance $Ke \cos \omega$ in the focus. The values of e and ω are read off by a finely graduated scale.

11. Professor Schlesinger's tables for b and c are based on a previous transformation of the equatorial coordinates α, δ of a star into λ, β, its ecliptical coordinates. The present tables do away with this transformation and furnish at once the right ascension A and declination D of the apex of the earth's motion. The correction x is brought upon the following form:

$$x = V\{\sin \delta \sin D + \cos \delta \cos D \cos (\alpha - A)\}.$$

The quantities $V \sin D$, $V \cos D$ and A are tabulated for every other degree of the circumference. Tables of difference for 1′ change in each one of these tabulated quantities are added to facilitate the calculation. This paper will be published in the *Astrophysical Journal*.

12. The paper by Professor Cairns is devoted to a generalization of the Hilbert theory of a quadratic form in an infinite number of variables. It embodies the results reached in work carried out as part of the requirement for the degree of doctor of philosophy at Göttingen. The investigation arose in seeking to adapt the method

of integral equations to the isoperimetric problem of the calculus of variation.

13. Professor Halsted considered the essence of inherent order, its foundation, genesis, and the uses of inherently ordered series in the attribution of factitious order to primarily unordered assemblages. He also investigated the betweenness relation, both linear and of more than one dimension.

14. The method of approximation developed by Poincaré for obtaining the terms of higher order of the perturbative function depends uniquely upon certain singularities of this function. With suitable numerical assumptions the case of small eccentricities and a small inclination of the orbits is carried out in detail by Dr. Reed, and the results to be found by varying the elements are indicated.

15. The paper by Professor Eisland contains a treatment of all the types of translation-surfaces which are determined by a unicursal quartic in the plane at infinity. The most important result is: To a unicursal quartic with three real double points correspond triply infinite types of translation-surfaces of a particular form. This paper is a continuation of one recently published in the *American Journal of Mathematics* by the same author under the title "On a Certain Class of Algebraic Translation-surfaces." It will appear in the same journal.

16. Dr. Ranum proved the following theorems: If S is a singular matrix not belonging to any group, then if the number of zero roots of its characteristic equation is s, there always exists a positive integer m which does not exceed s, such that S^m belongs to some group. If m is the lowest integer having this property then among the invariant factors of the characteristic determinant of S corresponding to zero roots there is at least one of order m and none of higher order.

17. There is a discrepency between the mathematical theory involved in the fundamental calculations of life, insurance contingencies and the policy contract itself which leaves some latitude and consequent confusion. The object of Professor Beckett's paper was to set forth this discrepancy and to find a solution that can be checked from the other items required to be computed and exhibited in the report of a company.

18. Surfaces characterized by having isothermal asymptotic lines and isothermal lines of curvature Dr. Young has called asymptotic-isothermic. In the present paper he considers special classes of such surfaces and thereby completes along certain lines a paper which he read before the Chicago Section of the American Mathematical Society several months earlier.

19. The term division has two distinct meanings in elementary mathematics. According to one of these it implies the operation of finding an integral quotient and an integral remainder, while according to the other it implies the finding of a number which, multiplied into the divisor, produces the dividend. While only the latter is the inverse of multiplication, yet it is customary to speak of division as an inverse operation without specifying which of the two commonly accepted definitions of the term is meant. A very common definition of multiplication is the performing upon the multiplicand the same operation as that which is performed upon unity to get the multiplier. The vagueness of this definition follows directly from the fact that 4 may be obtained by doubling unity and squaring the result, yet multiplying by 4 does not generally mean doubling the multiplicand and squaring the result. Such vague definitions are contrary to the very essence of mathematics and hence should be avoided.

Especial stress was laid by Professor

Miller upon the fact that dividing by 0 should be banished from elementary mathematics. The so-called indeterminate forms are really meaningless forms and it is questionable whether one should speak of evaluating such a form. As $uv=0$ has not always for its locus the combined loci of $u=0$ and $v=0$ the rule relating to this case should be stated with the necessary restrictions. The fact that the last letters of the alphabet are used both for variables and for unknowns in elementary algebra has led some authors to speak of these two very distinct concepts as if they were identical. This is the more unfortunate since the concept of a variable is continually playing a more fundamental rôle in elementary algebra. This paper will appear in *School Science and Mathematics.*

20. Photographic and visual magnitudes are determined in immediate succession with the 24-inch reflecting telescope; the photographic on ordinary plates, the visual on orthochromatic plates used with a suitable color-filter. The spectral types are obtained with an objective prism used on a 6-inch Zeiss doublet. The difference between the photographic and visual magnitudes, zero for white stars, increases progressively with the intensity of color and with the change in spectral type, giving a measure of color.

The distinctive features of the present work are: (1) The substitution of measures for eye-estimates of star-color, (2) the comparison of measured colors with spectral types.

Star colors ranging from $\frac{1}{2}$ to 5 or more magnitudes are found for types *F* to *N* in the Harvard classification. It is proposed to use these color-values as an improved method of stating star-colors. The paper will appear in the *Astrophysical Journal.*

21. In this paper Mr. Fox presents the evidences proving the identity of certain features seen on the calcium spectroheliograms and the eruptive prominences.

22. The objective was tested for zonal and astigmatic errors by Hartmann's method. The astigmatic errors are negligibly small. Hartmann has introduced a criterion for comparing various objectives, which is the mean diameter of the star image from the various investigated zones of the objective upon the mean focal plane expressed in 1/100,000 of the focal length. Data were given for the 40-inch objective of Yerkes Observatory and diagrams were exhibited. This paper will appear in the *Astrophysical Journal.*

23. Mr. Wallace considered the following points: Importance of the method to astronomers in general. Factors governing successful photographic results and the rôle of personality. The requirements and adjustment of filter and plate to the visual refracting telescope, illustrated by color curves of filters, plates and objective, and their combined effect upon the images obtained. Halation, and its influence upon the recording of faint or delicate details.

24. The paper describes a vertical cœlostat telescope recently erected on Mount Wilson. A 12-inch objective, mounted at the summit of a steel tower 65 feet in height, receives the sun's rays from a cœlostat and second mirror and forms an image in a house at the base of the tower. Professor Hale stated that the principal advantages of this instrument, as compared with the Snow telescope, are the better definition of the solar image and the much smaller change of focus during a given exposure of the mirrors to the sun. Photographs of the spectra of sun-spots made in the fourth order of a Littrow spectrograph of 30 feet focal length, mounted in a pit, excavated in the earth underneath the tower, were projected on the screen.

25. Solar spectra, corresponding to

points at the center and near the limb of the sun's disk, were photographed side by side on the same plate with a Littrow or auto-collimating spectrograph of 18 feet focal length, used in conjunction with the Snow telescope of the Mount Wilson Solar Observatory. The third or fourth orders of a 4-inch plane grating, having 14,438 lines to the inch, were employed. For the measurement of line displacements, spectra were photographed at points near the limb lying at opposite ends of a solar diameter, thus permitting the rotational shifts to be eliminated. Some of the more recent work has been done with a Littrow spectrograph of 30 feet focal length, used with the new vertical cœlostat or "tower" telescope of the Solar Observatory. This instrument is of the same focal length as the Snow telescope (60 feet), and thus the diameter of the solar image is about 6.7 inches in each case. The 4-inch grating, when used with the 30-foot spectrograph, gives a scale of 1 mm. = 0.58 Angströms in the third order and 1 mm. = 0.44 Ångströms in the fourth order. As the Fraunhofer lines are fairly sharp on the photographs, this great scale permits a high degree of precision to be attained in their measurement. Up to the present time, most of the work has been done in the region λ 3,800 — λ 5,800. It is therefore quite possible that the preliminary results given in this paper may not apply below *D* or in the ultra-violet. These results may be summarized as follows:

1. Most of the lines shown by our photographs of spot spectra to be strengthened or weakened in sun-spots, are similarly affected near the limb.

2. Many lines not affected in spots are strengthened or weakened near the limb.

3. Lines due to substances of high atomic weight are, in general, greatly weakened near the limb.

4. Winged lines undergo marked change in appearance, the wings being greatly reduced near the limb.

5. Among the lines considerably strengthened near the limb the most important are due to elements of comparatively low atomic weight. These include the *D* lines of sodium, the *b* lines of magnesium and the blue calcium line at λ 4,227.

6. Most of the lines in the spectrum are slightly widened near the limb.

7. Most of the lines are shifted toward the red, as compared with their position at the center of the sun.

8. These displacements are not due to ascending currents at the center of the sun (which would produce negative displacements of the lines in the solar comparison spectrum), since they have also been measured with the aid of an arc comparison spectrum.

9. The magnitude of the shift varies for different lines of the same element.

10. The strengthened lines, as a rule, seem to show smaller shifts than do the other lines.

11. The spark lines of a given element, as a rule, show larger shifts than do the other lines.

12. In many cases the relative displacements of the lines agree fairly well with those obtained by Humphreys in his laboratory experiments on the effect of pressure on wave-length.

13. The lines of the cyanogen flutings (λ 3,883.5 and λ 4,216.14) are not shifted from their normal positions.

14. The shifts of groups of titanium lines near λ 3,900, λ 4,500 and λ 5,300, and of groups of iron lines near λ 3,800, λ 4,400, λ 4,900 and λ 5,500, show progressive increase toward the red, and seem to indicate that the average pressure shift, for similar lines, is a function of the wave-length.

15. Photographs taken at intermediate points between center and limb indicate that the shifts fall off rapidly, and become very small at a short distance from the limb.

26. In order to obtain radial velocities from star lines that are not present in the comparison spectrum it is customary to use an interpolation formula to express the exact relation between wave-lengths and micrometer readings. These formulæ do not change much from plate to plate if the latter are all taken with the same spectrograph, and whatever differences there may be can be *largely* allowed for by adding to the micrometer readings (R) a linear expression: $a + b \cdot R$. Assuming that this is rigorously the case for short distances on the plate, it is shown that the error of this assumption can amount to a few hundredths of a kilometer per second in the case of plates taken with the Mellon Spectrograph of the Allegheny Observatory. Consequently it is only necessary to interpolate the place of a star line linearly between two comparison lines in order to obtain its displacement. This method has been tried on many plates at the Allegheny Observatory and has been found very convenient. The complete reduction of a plate in this way occupies about ten minutes.

27. The problem of Professor Moulton's paper is to find the possible rôle that the near approaches of the stars to one another may have played in sidereal evolution. The answer to this problem depends upon the extent of the sidereal universe, the number of stars in it, and the character of their motion. The discussion leads to the conclusion that the relatively near approaches of the stars have probably been an important factor in stellar evolution. The paper will be published by the Carnegie Institution.

The general committee elected Professor C. J. Keyser, Columbia University, vice-president and chairman of the Section, and Professor G. A. Miller, University of Illinois, secretary. The Section elected Professor G. B. Halsted, councilor; Professor F. R. Moulton, member of the general committee; Professors E. W. Brown and F. R. Moulton, members of the sectional committee—the former for five years and the latter for four years.

G. A. Miller,
Secretary

University of Illinois

The American Mathematical Society

The fourteenth annual meeting of the American Mathematical Society was held at Columbia University on Friday and Saturday, December 27–28, 1907, extending through two sessions on Friday and a session on Saturday morning. The attendance included fifty-three members. President H. S. White occupied the chair, being relieved by Vice-president P. F. Smith at the afternoon session. The following were elected to membership in the society: Mr. Charles Ammerman, McKinley High School, St. Louis, Mo.; Dr. C. S. Atchison, Williams College; Mr. B. H. Camp, Wesleyan University; Professor W. M. Carruth, Hamilton College; Mr. G. R. Clements, Williams College; Professor Julia T. Colpitts, Iowa State College; Professor J. N. Ivey, Tulane University; Professor W. H. Jackson, Haverford College; Mr. W. C. Krathwohl, Columbia University; Professor Murray Macneill, Dalhousie University; Mr. C. N. Moore, Harvard University; Professor Maria M. Roberts, Iowa State College; Mr. E. W. Sheldon, Yale University. Seven applications for membership were received.

In response to the invitation of Professor E. J. Townsend, it was decided to hold the

next summer meeting of the society at the University of Illinois. The date will probably be the second week of September. The data of the next annual meeting was fixed as December 29–30.

The membership of the society increased during the past year from 554 to 582, including at present 52 life members. The number of papers presented at all meetings, including those of the Chicago, San Francisco and Southwestern sections, was 166, and the total attendance of members was 396. The treasurer's report shows the gross income for 1907 to be $5,401.28, expenditures, $4,515.26; balance on hand at end of the year, $6,081.82, including $2,969.40 life membership fund. Sales of the society's publications amounted to $1,534.

Several important changes have occurred during the year in the administrative and editorial offices. Dr. W. S. Dennett retired in February from the treasurer's office, which he had held since 1899, and was succeeded by Professor J. H. Tanner, Professor E. H. Moore, who had served as editor-in-chief of the *Transactions* since its foundation in 1899, has retired, and is succeeded by Professor Maxime Bôcher. At the close of the year Professor Alexander Ziwet retired from the Committee of Publication, of which he had been a most valued member since 1893. The vacancy in the committee was filled by the election of Professor Virgil Snyder.

At the annual election, which closed on Saturday morning, the following officers and other members of the council were chosen:

Vice-presidents—James Harkness, G. A. Miller.
Secretary—F. N. Cole.
Treasurer—J. H. Tanner.
Librarian—D. E. Smith.
Committee of Publication—F. N. Cole, D. E. Smith, Virgil Snyder.
Members of the Council (to serve until December, 1910)—R. E. Allardice, Max Mason, G. D. Olds, M. B. Porter.

The following papers were read at this meeting:

F. L. GRIFFIN: "Certain families of central orbits with a constant apsidal angle."

F. L. GRIFFIN: "On the non-existence of certain types of periodic solutions in the problem of three bodies."

E. O. LOVETT: "On a problem in mechanics, Note II."

E. O. LOVETT: "On a class of periodic solutions in the problem of four bodies."

OSWALD VEBLEN and J. W. YOUNG: "A set of assumptions for projective geometry."

FRANK MORLEY: "The transformation of a Clifford configuration into itself."

R. G. D. RICHARDSON: "Lebesgue improper integrals."

E. W. BROWN: "The motion of the moon relative to a moving plane of reference."

E. W. BROWN: "The development of the infinite determinant."

ARTHUR RANUM: "Groups of singular matrices."

I. G. HARDY: "Curves in a space of n dimensions."

A. B. COBLE: "A reduction of the problem of solving a quintic to Klein's 'problem of the A's' by means of invariant theory."

L. I. HEWES: "The necessary and sufficient condition that an ordinary differential equation shall admit a conformal group."

J. I. HUTCHINSON: "Hermitian forms with zero determinant."

E. B. WILSON: "On the uniform rotation of a homogeneous chain about a vertical axis."

E. B. WILSON: "On the theory of double products and strains in hyperspace."

MAX MASON: "Note on implicit functions."

H. E. HAWKES: "On the equivalence of families of bilinear forms."

G. A. BLISS: "An existence theorem for a partial differential equation of the first order which is non-analytic."

The meeting of the Chicago Section of the society at Chicago, December 30–31, 1907, and January 1, 1908, was especially marked by joint sessions with Sections A and D of the American Association for the Advancement of Science, at which the teaching of mathematics to students of engineering was made the subject of an

elaborate discussion participated in by mathematicians and engineers.

The next meeting of the society will be held at Columbia University on Saturday, February 29. The San Francisco Section will meet at Stanford University on the same day.

F. N. Cole,
Secretary

THE AMERICAN PHYSIOLOGICAL SOCIETY

The twentieth annual meeting of the society was held at the University of Chicago, December 31 to January 2, 1907–8. It included joint sessions with the American Society of Biological Chemists and Section K of the American Association for the Advancement of Science. The following scientific papers were presented:

W. H. Howell and W. W. Duke: "Further Communication on the Effect of Vagus Inhibition on the Output of Potassium from the Heart."

O. Folin: "Protein Metabolism in Fasting."

J. J. R. Macleod: "Experimental Glycosuria."

L. B. Mendel: "Further Observations on the Parenteral Utilization of Carbohydrates."

H. D. Haskins: "Preliminary Report of Certain Investigations as to the Nature of Peptones."

A. P. Mathews: "The Spontaneous Oxidation of some Cell Constituents."

Waldemar Koch: "On the Chemical Study of Mental Disorders."

L. B. Stookey and V. Gardner: "Concerning the Pharmacological Action of Potassium Iodide."

H. Gideon Wells: "The Chemistry of Hypernephromas."

J. R. Greer (by invitation): "On the Composition of Normal Lymph from the Neck Lymphatics of the Horse."

Emil Osterberg and Charles G. L. Wolf: "Protein Metabolism in the Dog. The Metabolism with Low Caloric Values of Protein."

J. G. Ryan (by invitation): "The Presence of Glucose in Saliva."

S. J. Meltzer and J. Auer: "The Antagonistic Action of Calcium upon the Inhibitory Effect of Magnesium" (with demonstration).

C. F. Hodge and O. P. Dellinger: "A Comparative Study of the Cilium as a Key to the Structure of Contractile Protoplasm."

C. F. Hodge, D. Gibbs and O. P. Dellinger: "Daily Life of *Amœba proteus*."

J. F. McClendon (by invitation): (1) "The Reaction of *Amœba* to Stimuli of Small Area." (2) "The Effects of Prolonged Centrifugal Force on *Paramœcium*."

R. M. Yerkes: "The Relation of Plasticity to Age in the Dancing Mouse."

B. Brande (by invitation): "The Bacterio-agglutinating Action of Lymph under Different Conditions of Lymph Formation."

T. Hughes (by invitation): "The Relative Hemolytic Action of Serum and Lymph under Different Conditions of Lymph Formation."

S. J. Meltzer and D. R. Joseph: "The Effect of Stimulation of the Vagi upon the Onset and Development of Rigor Mortis of the Mammalian Heart."

A. B. Luckhardt (by invitation): "The Osmotic Concentration of the Blood during Anesthesia."

W. T. Porter, W. I. Clark and F. H. Pratt: (1) "On Differences between the Bulbar and Spinal Vasomotor Cells." (2) "The Reactions of Peripheral Vasomotor Areas."

W. T. Porter, R. Richardson and H. K. Marks: (1) "A Comparative Study of Vasomotor Reflexes." (2) "Vasomotor Reflexes after Excessive Hemorrhage."

C. C. Guthrie: "Survival of Tissues and Organs under Perfusion."

A. J. Carlson and W. J. Meek: "On the Mechanism of the Embryonic Heart Rhythm."

S. Hatai: "Comparison of the Nervous System in the Normal Albino Rat with the Nervous System in those Experimentally Stunted."

I. H. Hyde: "A Study of the Respiratory and Cardiac Activities and Blood Pressure in the Skate, following Intravenous Injections of Salt Solutions."

J. Erlanger, J. R. Blackman and E. K. Cullen: "Further Studies on the Physiology of Heart Block in Mammals. Chronic Auriculoventricular Heart Block in the Dog."

G. W. Crile (by invitation): "Observations on the Effect of Excessive Transfusion of Blood."

C. Sihler (by invitation): "The Disputed Points in the Histology of the Submaxillary Gland and their Physiological Importance."

W. B. Cannon: "Some Observations on the Neuro-muscular Mechanism of the Alimentary Tract."

C. W. Edmunds and G. B. Roth: "The Relation of Curara to 'Nerve Ending' and 'Receptive Substance.'"

W. P. LOMBARD: "Evaporation of Water from the Skin and Air Passages of Men at Rest."

J. R. MURLIN and J. H. HUBERMAN: "Observations on the Influence of Carbohydrate on Protein Metabolism."

T. B. OSBORNE: "Pyrimidine Derivatives in Nucleic Acid."

C. L. ALSBERG: "Concerning the Guajac Reaction."

P. B. HAWK: "On the Leucomains of Cod Liver Oil."

A. P. MATHEWS and R. H. NICHOLL: "Ionic Potential and Toxicity."

T. B. ALDRICH: "A Preliminary Contribution to the Chemistry of the Infundibular Portion of the Pituitary Gland."

A. J. CARLSON, J. R. GREER and F. C. BECHT: "Some Points in Lymph Formation."

F. C. BECHT (by invitation): "On the Nature of the Heat Paralysis in Nervous Tissues."

F. H. PIKE (by invitation): "Studies in the Resuscitation of the Central Nervous System."

F. C. MCLEAN (by invitation): "Further Studies on the Relation of the Oxygen Supply to the Composition of Saliva."

W. J. MEEK (by invitation): "The Structure of the Heart Muscle of *Limulus*."

W. S. HALL: "Human Chyle as modified by Diet."

A. WOELFEL (by invitation): "An Attempt to Determine the Mechanism of Protein Metabolism in Starvation."

F. S. LEE: "Pseudo-fatigue of the Spinal Cord."

C. D. SNYDER (by invitation): "The Temperature Coefficient of Nervous Conduction as Determined on the Ischiadicus of the Frog."

Demonstrations and Exhibition of Physiological Apparatus

G. W. CRILE (by invitation): "The Resuscitation of Animals killed by Anesthetics" (with demonstration).

A. J. CARLSON, J. R. GREER and F. C. BECHT: "The Relation of Organ Activity to Lymph Formation in the Salivary Glands" (with demonstration).

J. ERLANGER: "A New Criterion for the Determination of the Systolic blood Pressure with the Sphygmomanometer" (with demonstration).

W. KOCH: "Demonstration of an Apparatus for the Extraction of Nerve Tissues."

E. P. LYON: "Demonstration of a CO_2 apparatus."

W. T. PORTER: "An Improved Kymograph."

W. P. LOMBARD: "Demonstration of a Model showing Effects of Lesions of Heart Valves and 'Compensation' on the Circulation."

W. P. LOMBARD: "A New Form of Electric Signal."

The following were elected to membership in the society:

Dr. William H. Schultz, University of Missouri, Columbia, Mo.

Dr. Carl J. Wiggers, University of Michigan, Ann Arbor, Mich.

Dr. Joseph L. Miller, Rush Medical College, University of Chicago, Chicago, Ill.

Dr. Albert Woelfel, Physiological Laboratory, University of Chicago, Chicago, Ill.

Dr. Oris P. Dellinger, Clark University, Worcester, Mass.

Dr. Edward B. Meigs, Harvard Medical School, 240 Longwood Ave., Boston, Mass.

Dr. Lawrence J. Henderson, Harvard Medical School, 240 Longwood Ave,, Boston, Mass.

Dr. C. Judson Herrick, University of Chicago, Chicago, Ill.

Dr. George W. Crile, 1021 Prospect Ave., Cleveland, Ohio.

Dr. Robert Banks Gibson, University of Missouri, Columbia, Mo.

Dr. Christian Sihler, 2700 Vestry Ave., Cleveland, Ohio.

Dr. Edgar D. Brown, University of Minnesota, Minneapolis, Minn.

Dr. Charles D. Snyder, 1408 Park Ave., Baltimore, Md.

Dr. Leo Loeb, Medical Department, University of Pennsylvania, Philadelphia, Pa.

Dr. Frank Henry Pike, Physiological Laboratory, University of Chicago, Chicago, Ill.

Dr. John B. Watson, University of Chicago, Chicago, Ill.

Dr. Hugh McGuigan, 4336 Laclede Ave., St. Louis, Mo.

The following distinguished physiologists were elected to honorary membership in the society:

Professor Eduard Pflüger, director of the Physiological Laboratory, Bonn, Germany.

Professor Carl v. Voit, director of the Physiological Institute, Munich, Germany.

Professor Olaf Hammarsten, Upsala, Sweden.

The society adopted the recommendations of the Committee on Protein Nomenclature of the American Physiological Society and the American Society of Biological Chemists and recommended its publication as a

joint report. The complete report will be published later in SCIENCE.

Appropriate resolutions were passed respecting the late Professor W. O. Atwater, of Wesleyan University, and Professor G. P. Clark, of Syracuse University, both members of the society.

The following officers were elected for the ensuing year:

President—Professor W. H. Howell.
Secretary—Professor Reid Hunt.
Treasurer—Professor W. B. Cannon.
Additional members of the Council—Professors J. J. Abel and G. Lusk.

Forty-five members of the society were in attendance during the meeting.

LAFAYETTE B. MENDEL,
Secretary

SHEFFIELD SCIENTIFIC SCHOOL,
YALE UNIVERSITY,
NEW HAVEN, CONN.

WILLIAM SMITH CLARK: HIS PLACE AS A SCIENTIST AND HIS RELATION TO THE DEVELOPMENT OF SCIENTIFIC AGRICULTURE[1]

IT is no ordinary occasion of rejoicing or of interest in the progress of technical education which brings us together here to-day, but rather is it an event full of significance and rich in the promise of benefits to that great industry which must ever be recognized as the foundation of all national prosperity. This event has a twofold significance, in that it marks one feature in the celebration of the fortieth anniversary of the foundation of this college; but more particularly that it celebrates the dedication of this dignified and well-equipped building, abundantly suggestive of lofty ideals, persistent endeavor and resolute purpose, to the service of scientific research and to the memory of one whose most cherished plans lay in the domain of botanical science; whose best influence was exerted in behalf of scientific agriculture when that science was yet in its infancy; whose best energies were directed toward laying—strong and sure—the foundations of an institution whose mission he believed it to be to become a leader in agricultural education. These ideals have been largely realized through the influence this college has exercised upon domestic agriculture and the progress of this important branch of industry in far-off oriental lands; and now, through the renewed vigor imparted to it in recent years by a wise policy of practical encouragement, and under the administration of your new president, it would seem as if the coming years were to be rich in the fruits of a widening and deepening influence upon the interests she holds in her keeping.

It is a matter of special gratification that I am privileged to witness the great progress this institution has made since its foundation in 1867, and more particularly the very rapid advances of the last two decades. As one who enjoyed the peculiar friendship which comes through close association in scientific work and the companionship of the teaching profession, it affords me a peculiar sense of satisfaction to be able to participate in the dedication of this building, designed as it is to stand as an exponent of the best scientific ideals, and as a memorial of one who not only exerted a strong influence upon his profession and upon those who were fortunate enough to come under his teaching, but for whom I have always entertained a high personal regard, and to whom I feel indebted for some of the best inspirations of my professional career.

The particular purpose of my presence here to-day is not so much to present you with a biographical sketch of President Clark, as to direct your attention to his relations to the development of botanical science in this country; to show what influ-

[1] An address delivered at the opening of Clark Hall, Massachusetts State College, October 2, 1907.

ences have been associated with his scientific work; and to indicate both the present position of and the future outlook for those special lines of research in which he always manifested a keen interest, and in which he would have taken an active part had circumstances permitted him to continue his useful life. But inasmuch as a clear insight into a man's scientific aptitudes, his capacity for research and his influence upon his chosen profession can be gained only through a knowledge of his temperament, mental attitude and early training, I may be pardoned for reference to some of those personal characteristics which distinguished him among his associates, and which were best revealed to those intimately connected with his scientific work and familiar with his thoughts and aspirations. Through the perspective afforded by time, it becomes possible to gain that just appreciation, and to establish that correct measure of his work, which are possible only when a man's efforts are divested of those less important but often numerous factors which tend to minimize and obscure.

President Clark used to relate with a certain element of justifiable pride, but never in a spirit of boastfulness, that as a boy he always made it a rule to run faster, jump farther and higher, fight harder and swim more strongly, than any of his companions. The determination to excel in whatever he undertook was one of the first of his traits to impress itself upon the stranger. Those who knew him intimately, readily appreciated this side of his character and understood that the dogged persistency with which he pursued any cherished plan, or sought to gain the ascendancy in competition, was an important factor in his career. It carried him through the civil war and the terrible days of the wilderness campaign; it placed this institution on a secure and enduring foundation, which, in spite of its apparent lack of progress for many years, and the periods of despondency which at times come to all healthy organisms, will make it abundantly able to sustain that splendid superstructure of usefulness which seems to lie before it. It carried him to the far-off east, where his memory is firmly enshrined in the hearts of the Japanese, who, to this day, hold his name in the highest esteem as that of one who conferred great benefits upon their country. Throughout his entire career, the force of his living example was of inestimable benefit to his students, and of far greater value than spoken words. These, when uttered, were generally few but full of virile force and significance, and certain to leave a lasting impression. On one occasion he wished to have a number of diagrams to illustrate his lectures on botany, and for this task he selected one of his graduate students to whom such work was entirely new. The unfortunate student was presented with a figure embodying much difficult detail, and was told to reproduce it upon an enlarged scale. Claims of inexperience in such work were not heeded, and the only response to the plea of inability was contained in the very curt command "Do it." Being thus driven to an extremity, and having his pride touched, the student did draw the diagram to the satisfaction of President Clark, and afterwards produced several hundreds of other figures for the same purpose. The phrase "Can not" was entirely unknown to President Clark, but his simple watchword "Do it" seemed to be the slogan guiding him to success in whatever he undertook, as it has since then served to inspire several generations of students in more than one land. An intense enthusiasm characterized his attitude toward everything which he regarded as worthy of his attention, and this spirit successfully bridged many a difficult situation which might have been full of

impossibilities for one of a less sanguine temperament.

A keen judge of men, he always surrounded himself with those who could not only execute with ability, but who were able to appreciate and participate in his own enthusiastic efforts. Those who are familiar with the earlier years of this college will readily recall that they were conspicuous for the able men by whom he was supported, all of whom have made their mark in their chosen callings: Stockbridge, than whom none has made a deeper impression upon modern agriculture; Miller and Peabody, profound and careful students of the mathematical sciences; H. J. Clarke, whose name for a brief period shed luster upon this institution through his knowledge of the biological sciences; Goodell, cultured and versatile, and in his later years the able president, well beloved of all who knew him. These were the men who helped to make this institution what it is, whose record is written large in the great book of life, and whose memories will ever be an inspiration to future generations of students. But among this galaxy of able men there was one whose selection for so important a post in the new college was based in part upon student friendship at Göttingen, but more upon a keen appreciation of sterling worth; one whose ability as a scientist continues to shed luster, add renown and lend dignity to this institution; and it is a matter of special congratulation that he is yet with us to participate in this act of tribute to the memory of an old friend—Dr. C. A. Goessmann.

President Clark's professional career was begun in fields quite distinct from those which he cultivated in later years. Under the guidance of Professor Hitchcock, he acquired a great taste for geology, and this, together with a special aptitude for chemistry, led him to choose this branch of science in connection with mineralogy, in which he had gained distinction as a student. It was in pursuit of a further knowledge of these subjects that he went to Göttingen to seek instruction at the hands of eminent German specialists, at a time when it was just becoming fashionable for American students to complete their studies and professional training at German universities. This step was taken at one of the most critical periods in the development of American science, which was then in a state of transition from generalization to specialization. Owing to his keen perception and quick observation, as well as to his ready appreciation of anything which tended in the direction of progress, the experience gained during his residence abroad was of great service in after years. The one great lesson which this period of his life seems to emphasize is the important reciprocal relations of botany and chemistry, and the teachings of his later years always brought into prominence the idea that, for the professional botanist, a thorough groundwork of chemistry is not only essential, but that the more one specializes in botany the wider should be his knowledge of chemistry. At the present day, with our strong tendencies toward narrow specialization, we are in great danger of losing sight of this fundamental fact, and I would impress upon students and teachers the great importance of shaping courses of study in such ways as to secure and maintain a proper balance between these two subjects.

While yet a student at Amherst College, President Clark had followed the usual course in botany as then prescribed by the college curriculum, and although he was not particularly drawn to the subject at that time, he nevertheless pursued it with characteristic zeal and gained proficiency in the methods then in vogue. These were based upon the Linnæan school, which

taught the doctrine of the fixity and special creation of species, and regarded purely morphological and taxonomic questions as the chief aim of the science. His keen perception and receptive mind nevertheless enabled him to see, while yet a student in Germany, a very different future for botanical science. This was first brought to his attention on the occasion of a visit in 1850, to the Royal Gardens at Kew, England, then under the able direction of Sir William J. Hooker. He there observed for the first time the enormous resources of plant life, and the extent to which plants are capable of contributing to man's welfare; he there saw in the Victoria regia and in many other rare and striking examples of exotic plants the great possibilities they presented for an extension of man's intellectual and esthetic interests; and in the vast amount of material gathered from all quarters of the globe he recognized the great opportunities for an extension of scientific knowledge along the most attractive and useful lines. He became profoundly impressed with the importance and the far-reaching character of the problems thus presented, and from that time on his thoughts were largely occupied with botanical questions. It was the experience gained at that time which had so marked an influence upon the early plans for the development of this college. This was eventually expressed, among other ways, in the formulation of plans for a botanic garden, unfortunately never realized; in the construction of the Durfee Plant House, and in the building of a botanical museum, both very modest but exceedingly useful efforts to follow the suggestions of the Kew Garden, from which institution the first skilled gardener was obtained. More than this, however, it permitted the formulation of plans upon a broad basis, and an intelligent and far-reaching conception of the true relations in which scientific knowledge must always stand toward scientific agricultural practise.

It is certainly true that an institution such as this must always be prepared to educate a certain number of men in the theory and practise of agriculture, but all modern experience tends to show with increasing force the subordination of such training to that which gives a man a special skill in some one or more of the sciences which may be applied to that industry. No more striking instance of the correctness of this point of view could be obtained than one which was brought to my notice recently, as contained in an address delivered to the West Indian students of McGill University by Sir Daniel Morris, commissioner of agriculture for the West Indies. Sir Daniel has supervision of the agricultural interests of the entire British West Indies, including Honduras, Guiana and other colonies within the continental area. His experience in the agricultural needs of that region has been both wide and prolonged, and the services he has rendered are such as to give his opinion special weight. In directing the attention of his hearers to the useful and lucrative careers which are open to properly-qualified men, and the great influence they may exert in the promotion of agriculture there, he placed special emphasis upon the statement that special knowledge of purely agricultural problems, gained elsewhere, would be useless. What is needed are men specially trained in those sciences such as chemistry, plant pathology, plant physiology and entomology, which may be applied directly to the solution of great problems relating to conditions of soil, diseases of plants, the general question of nutrition and the operation of destructive insects. Through such channels it would be possible for an expert to gain the confidence of the farmer and

confer the most lasting benefits upon the agriculture of the region.

It was this point of view which gave to this college its real stability where others have shown so much weakness or have failed in their original purpose, and it is a continued recognition of this relation which will secure for the future the leading rôle which it should occupy and which I feel confident it will always maintain.

The experience of those early years was gained at the most interesting period in the history of botanical science. Darwin, adding the result of his own critical investigations to those of previous observers, had been able to sum up the work of one hundred years and present an intelligent conception of the reproductive processes in the higher plants, together with a knowledge of the relations which insects bear to such processes; both Darwin and Wallace were at that time engaged upon that memorable work which threw such a flood of light upon the origin of species, abolished the old conception of special creations and gave to the world one of its most powerful intellectual impulses; Lawes and Gilbert were deeply engrossed in attempts to solve the nitrogen problem and the broader question of plant nutrition in general; the modern microscope was then in its infancy; microtomes were as yet almost unknown; and the various critical methods of differential staining and other methods in technique which have contributed so much to the advancement of scientific research, were entirely foreign to the knowledge of the so-called microscopist. But among German botanists there was, nevertheless, a movement in progress to cast aside the fetters which for so long a time had bound the science to a purely morphological and taxonomic point of view, and to seek a wider, more attractive and more broadly useful field of investigation in the domain of anatomy and physiology. Many prejudices and preconceived notions had to be overcome, but this was successfully accomplished by Sachs, whose memorable work, published in 1874 and soon translated into English, opened up an entirely new vista and established what has since come to be known as the new school of botanical science. The dogmatism which had for so long a time characterized and dominated scientific thought and teaching rapidly gave way to speculation and freedom of thought, and the way was thus opened for the introduction of those reforms which have followed in such rapid succession during the last thirty years. Hypotheses which were regarded as all-sufficient in 1860 or 1875 have become greatly modified or even abandoned within the last ten years; physiology has assumed a new position and importance and is to-day directing the general course of investigations in whatever department of the subject of botany they may lie; pathology has attained to a position of dignity, attractiveness and importance which not only enlists the energy of the best-trained minds, but appeals with special force because of the great scientific and economic importance of the results which flow from it. The influences which were thus at work during the earlier period of President Clark's professional career were such as to produce a profound impression upon an observing mind, and even those of us who can recall the closing years of this transition period retain a very vivid impression of the powerful stimulus afforded by the alluring prospects presented by the new lines of research, and the opportunity for profitable discovery presented by the new methods.

The trend of thought and the spirit of investigation thus awakened appealed to President Clark with peculiar force and led him to place the new opportunities before his students with successful results, and he may be regarded as one of the first

in America to adopt this advanced position. He thus set in motion at this college influences of the greatest importance to the progress of botanical science, which, centering here, later extended to far-away Japan, where such views had not then become known, to various parts of the United States and eventually to Canada. It is a matter of no small moment, and one upon which this institution may well be congratulated, that it was one of the pioneers in giving to the new world correct conceptions of the principles of the new school of botany, in accordance with which it has been possible to realize the great scientific and economic achievements of the last quarter of a century within the domain of that science.

President Clark's claim to scientific recognition rests not so much upon his actual achievements in research as upon his administrative capacity and the intelligent manner in which he stimulated and encouraged investigation on the part of others. As a matter of fact, his only exploit in original botanical work is recorded in the report entitled "The Phenomena of Plant Life." In this paper he undertook to present the results derived from a repetition of Hales's classic experiments, but with greatly improved apparatus of his own devising. This work extended over a period of three years and dealt with a variety of phenomena of great popular interest and much scientific importance. But the portion which claims our special attention is that relating to the movement of sap in trees. To this obscure problem which had claimed the attention of botanists, and had been the subject of more or less profound investigation for three hundred years, he contributed new facts of great value. Although the subject has, of late, received renewed attention, and the resources of greatly improved methods and apparatus have been utilized, the results obtained here in 1874–76 remain unchallenged. Indeed, they afford some of the most reliable data obtainable, and one of the best explanations of the phenomena within the limits of the ground covered. No discussion of the subject can be entered upon without reference to this important work. I desire to emphasize this fact, not only because it indicates the great scientific value of the problems which President Clark was prepared to enter upon, as well as his capacity for their solution, but it serves to make clear his connection with another movement of great significance and far-reaching importance. But before leaving this aspect of our subject, one other item must be added to the scientific work thus indicated, as represented by his successful efforts with respect to the introduction of new or little-known species of Japanese plants. The collections at this college afford abundant evidence of the zeal with which this work was carried out, and the success which attended his efforts.

In 1834 John Bennett Lawes, afterwards Sir John, established at Rothamsted, England, a special station for the investigation of problems relating to the nutrition of plants. This work was suggested by the celebrated investigations of De Saussure, and for a period of nine years it was carried on in a tentative way. But in 1843 it was entered upon on an enlarged scale with improved facilities; and through the cooperation of Dr., afterwards Sir, Henry J. Gilbert the work was carried out on the original lines until the death of the latter brought it under the management of a special trust devised by Sir John Lawes some time before his death. The subsequent establishment of a system of experiment stations throughout Germany, but under government control, gave this movement a powerful impulse which eventually brought it across the Atlantic to our own shores. The example thus set made a deep

impression upon the receptive mind of President Clark, and it was one of his cherished plans that such a station should be established here. This hope has been realized, although the fulfilment was not accomplished until several years after his death; though it must be conceded that his scientific observations, together with those of Goessmann and Stockbridge, constituted the real commencement of the Hatch Experiment Station, and gave a powerful impulse to a movement which at that time was hardly more than a suggestion, but which has since resulted in the establishment of similar stations throughout the United States and Canada.

My first recollections of President Clark go back to that early period in the infancy of this college, when technical training in the principles and practise of agriculture was an untried problem; when the young institution was forced to grapple with all the uncertainties of a future which too often received the open and hostile criticism of many otherwise intelligent and progressive citizens. Many were the sore trials and bitter disappointments of those early years, but, fortunately, there was a man at the helm who never wavered in his firm conviction that the agriculture of the future must rest upon a sound basis of scientific knowledge, and who never swerved from what he regarded as a correct policy. To his task he brought not only firm convictions, but an enthusiasm and determination which enlisted the respect and hearty sympathy of all his colleagues, as well as of many influential friends; carried conviction to the wavering and brought success where failure might have been looked for. His critics have been wont to censure him for an enthusiasm which they believed to sometimes carry him beyond the limits of safety, and this may have been true in some instances. Enthusiasm is one of the first requisites of a successful teacher and investigator, and although due conservatism in its exercise is most desirable, an excess is no more to be condemned than undue caution. It was a favorite maxim of President Clark's that a man who never made a mistake was one to be carefully watched. The most successful of men are guilty of errors of judgment which find their justifiable excuse in the great value of their achievements. The over-cautious man who never blunders is thereby characterized by the possession of negative qualities which are rarely, if ever, capable of contributing materially to the general progress and welfare. Boldness of action and resolute decision, promptness of execution, tempered by a cool and accurate judgment, are the qualities which bring success and command the respectful consideration of our fellow men.

As one of those who were intimately associated with President Clark in his work in Japan, and who, from its very inception, was able to gain an intimate knowledge of his purposes, it is proper that I should make some reference to that portion of his career which had to do with a most progressive, intelligent and refined people of great intellectual power. His entire period of service under the Japanese government extended over less than one year, but during that time he laid the foundation of a most successful college of agriculture, which has since outgrown its original purpose and has enlarged its sphere of usefulness to that of a university, of which the college of agriculture remains one of its most important features. Several of the students who commenced their courses of study under the guidance of President Clark have since then studied in the United States, from whose leading universities they have taken higher degrees with distinction. One of these now presides with ability over the destinies of the new uni-

versity at Sapporo; another is a distinguished professor of botany in the same institution; a third enjoys eminence as one of the most distinguished literary men of Japan, with a high repute as a scholar in foreign lands; while others have won distinction in various callings in their native land.

There is probably no part of President Clark's work which has left so enduring an impression and influence as his participation in the efforts of Japan to introduce the best in our western civilization. His success in this undertaking was based in part upon his appreciation of great public utilities, and in part upon his enthusiasm and ability as a teacher; and it was largely in consequence of the stimulus imparted by him that so many of the students of the Sapporo College sought and won distinction in the domain of science and literature. His administration at Sapporo was governed by the same broad-minded policy and comprehensive views that gave success to the parent institution, and it is one of the most prominent features of both colleges that, in spite of his strong, scientific inclinations, he recognized the importance of a liberal culture combined with ability to meet the practical issues of life. It is this breadth in scientific training, this all-round culture and capacity for work, and ability to deal with every-day problems, that has given to the graduates of both institutions the element of success—they have been trained to the best ideals of useful citizenship.

I should like to enlarge upon the present position of and future outlook for both physiology and pathology in this institution, because of the important historical relation in which President Clark's work stands to both of these very important subjects, but the limitations of the present occasion will not permit me to do so. But I can not avoid a reference, in closing, to the very important connection which must ever exist between the work of this college and the biological sciences. It requires but a moment's reflection to appreciate the enormous values represented by the various agricultural interests directly affected by the operation of disease and the depredations of destructive forms of insect life. For this reason, if for no other, the study of zoology must always find a prominent place in the curricula of institutions dealing with agricultural problems. But when we further reflect that such interests are, after all, secondary to those in which botanical science is concerned, because all forms of animal life are primarily dependent upon plants for their sustenance, it becomes evident that the study of botany, in its many-sided aspects, is of paramount importance, and that it is, after all, the real foundation of scientific agriculture. For this reason it finds a peculiarly appropriate place in our agricultural colleges, and I have for a long time been under the impression that there are no institutions where it may be more profitably cultivated, not only with reference to its direct application to the solution of great economic problems, but with reference to its purely scientific aspects; for, after all, the practical side becomes possible only after the purely scientific side has been dealt with. It is for these reasons that economy is finally gained by securing to botanical departments a competent staff and a thorough equipment in buildings and apparatus; and the fact that this dedication is being held to-day is abundant evidence that the people of Massachusetts appreciate to the full the far-reaching importance of the work to be executed here, under the able direction of Dr. Stone and his assistants.

But I would further point out that nature's processes, although exceedingly certain of fulfilment, are nevertheless exceedingly slow. If it has taken 500,000,000 of

years to shape this earth and render it a fit habitation for man, man himself must not be impatient if he is required to spend a few years of arduous toil that he may unlock some of the doors which so carefully guard nature's secrets. Sixty-three years sped on their way from the time when Boussingault first endeavored to ascertain the source of nitrogen in plants, until a satisfactory explanation was reached through our knowledge of the action of root tubercles; and for more than sixty years Lawes and Gilbert sought the solution of plant nutrition without gaining the end in view.

The laws of nature are not kept on draught, as it were, to be drawn in large or small quantity, according to the demand. To present a problem to an investigator and expect an immediate solution, or an immediate practical application, is to be prodigal of a costly equipment, to sacrifice unnecessarily the best and most carefully trained intellectual strength, and to bring discouragement and invite failure. It is, no doubt, true that when a commonwealth has invested a large amount of capital in specially trained men and expensive apparatus, it is reasonable to ask for results, and with this no fault can be found. The danger lies in the fact that sufficient opportunity is not allowed for the careful working out of a problem in all its scientific aspects. Under conditions of haste and undue pressure, the results, if worth anything, are very likely to be incomplete and unsatisfactory, and in too many cases they must be subject to costly revision. I feel disposed at this time to make an appeal to the citizens of this commonwealth to secure to the investigators who will occupy this building, as well as to all others in this college, freedom for the future, from an incubus which, in the history of our experiment stations of the past, has for many years been prolific of disastrous results. I do this because this building should stand as an exponent of the best scientific work and thought, and because I know of no body of men, other than the citizens of Massachusetts, to whom such an appeal may be made with greater assurance of an intelligent hearing, and a fairer prospect that they will apply the remedy, *patience*.

And now to the students of this college, as to those who are to follow you in after years, my best hope is that as you view this building from across the campus, or as you enter its halls for the pursuit of science, you may ever hold it as an inspiration to high ideals, persistent effort and unflinching purpose; and that in whatever walk of life your lot may be cast, you will ever keep before you the example of him whose name it bears, taking up your burden of life in all cheerfulness and hope, and whatever your task may be, with the firm resolve to "Do it."

D. P. Penhallow

McGill University

Scientific Books

Memoir and Scientific Correspondence of Sir George Gabriel Stokes. Selected and arranged by Professor J. Larmor, Sec. R.S. Cambridge. The University Press. 1907. Vol. I., pp. 475; Vol. II., pp. 507.

Biographical literature, if one may judge by the notices which have been written of late years, appears to admit of criticism more easily than almost any other form of history which is not written entirely from the point of view of the student. Whenever, as in the present case, the materials are plentiful and easy of access, the reader is almost entirely at the mercy of the writer, so that the latter may, by his method, give what impression he will of the character which he desires to unfold. In any case, it is a difficult matter to settle what is of permanent value in the life of any man who has left his mark on the men of his generation or who has added to the general store of knowledge. The difficulty is not less

in the case of a man whose life-work and influence are chiefly recorded in his own publications or in those which he has inspired, and whose thoughts and ideas are chiefly of interest in so far as they have affected his work. Stokes is perhaps a typical example of this class. Whatever value we may feel disposed to place on his ideas in religion, politics or education, there can be no doubt that the subjects of chief interest are his methods of work, his ideas on scientific questions, the way in which he made his influence felt in his chosen line of work, and chiefly, the mental make-up and environment which contributed to his success.

Professor Larmor, in selecting from the materials at his disposal, has kept these principles fully in view. In order to do so, he has broken new ground by showing the form which the biography of a scientific man may take, and the innovation is undoubtedly a success. He has not attempted to write the life himself nor even to give his own ideas of what Stokes has achieved. Indeed, he has, in the two volumes, contributed little else than explanatory details, leaving the memoir and summaries to the chosen few who were most closely associated with Stokes in the various lines of thought which the latter followed. The memoir by Mrs. Laurence Humphrey, the daughter of Sir George Stokes, and appreciations by Professor Liveing, Sir Michael Foster, Sir William Huggins and the Right Rev. Bishop G. F. Browne, serve to give a just idea of the life and character and to avoid the inevitable bias of a single point of view. Nevertheless, we may, perhaps, regret the omission of a summary of Stokes's work from one so well qualified to give an opinion as Professor Larmor.

From the historical side, the life of Stokes may almost be said to be the focus of the scientific activities of the last half century. His position as secretary of the Royal Society for over thirty years and as president for five years, naturally kept him in touch with all that was going on. But even more influential on the men of his day was his unselfish willingness to give his time and thoughts to any one who wished to consult him on a scientific question or to obtain his assistance in the solution of some difficulty. His first opinions on any debatable point were rarely wide of the mark and he would nearly always throw out some suggestion or idea which would enable the recipient to get at the root of the matter. Thus his letters, and these were not few or scanty, show the extent to which scientific progress has been advanced by him. This is perhaps nearly as well shown by the letters which he received. Of these the editor has inserted a larger number than might have been expected, perhaps owing to the materials at his disposal, for Stokes never destroyed any papers, and one may fear that all his correspondents had not been so careful.

In pursuance of the two-fold object—the work and career of Stokes and the scientific history of the latter half of the nineteenth century—Professor Larmor has subordinated the chronological order of the letters to the subjects of which they treat whenever this was necessary. A glance at the dates, everywhere supplied, will always give the former. Thus, in the second volume, there is a series of names under each of which will be found a collection of letters to some one correspondent, usually on a particular subject. Even when Stokes's letters to his correspondent were not available, the replies, with notes furnished by the editor, are sufficient to show what part Stokes had played in the development of the subject. Professor Larmor has also taken much care in the selection of headlines, so that one may rapidly find what is needed by simply turning the pages over.

A few extracts from the excellent memoir of Mrs. Laurence Humphrey will best show how she has contributed those circumstances and ideas which are of chief interest. On page 10:

> He considered that many of the men who worked under him in later years had been much overtrained and that this tended to weaken their minds and diminish their power of originality. He had heard of a machine for stuffing live fowls, to which he likened the process, and sometimes said, "They are stuffed, they won't do anything more, the thinking has been done for them." He considered this to be the reason why some of

those who took very high places in the Mathematical Tripos did so little afterwards.

Again on page 34:

He had two really wicked characteristics, that he would never allow any one to help him with his work, not even permitting invitations to be answered for him, and that he kept every single thing he received by post, even advertisements.

On page 36:

Lord Kelvin's visits were occasions of enjoyment to him, and great were the discussions between them, which anything served to begin; for instance, the eggs were always boiled in an egg-boiler on the table, and Lord Kelvin would wish to boil them by mathematical rule and economy of fuel, with preliminary measurements by the millimeter scale, and so on.

On page 44:

One day especially his silence in the House [of Commons] was remarked. Some scientific question had come up and still he said nothing. When we afterwards asked him why, he answered that he had been prepared to rise, but that another person had obviously wished to speak and had said enough, although he had treated the subject from a different standpoint from that which he should have himself adopted. Only one member beat him in regularity of attendance, Sir Richard Temple, who, however, lived in London.

Amongst the series of letters, one striking omission will be noticed, the absence of any correspondence with Lord Kelvin. We are glad to learn from the preface that these suffice to form a collection by themselves and that it has been decided to publish them separately, with a memorial of the lifelong friendship and collaboration of the writers. Of the numerous scientific matters which are treated in the letters given, it is only possible to mention one or two. In a letter to Sir Henry Roscoe dated February 7, 1862, he gives his share in the history of solar chemistry, which, in view of the off-repeated rumors that he had really antedated Kirchhoff, must be regarded as settling the question. He adds, "for I never published anything on the subject and if a man's conversations with his friends are to enter into the history of a subject there is pretty nearly an end of attaching any mention or discovery to an individual." As an instance of the gradual development of the theory of waves and heavy ocean swells we may turn to a long series of letters full of details and carefully thought-out ideas.

In conclusion, one must give high praise not only to the editor for the way in which he has done his work in compiling this biography and to those who have assisted him, but also to the Cambridge University Press for a couple of volumes which are issued in a form suitable either for continuous reading or careful consultation.

E. W. B.

YALE UNIVERSITY

American Birds. Studied and photographed from life by WILLIAM LOVELL FINLEY. Illustrated from photographs by HERMAN T. BOHLMAN and the author. New York, Charles Scribner's Sons. 1907. Pp. xvi + 256.

In an attractive volume of moderate size Mr. Wm. Lovell Finley describes in popular style the habits of a considerable number of western birds from the rufous humming-bird to the golden eagle. For the pictures, most of which are excellent, we are equally indebted to Mr. Herman T. Bohlman, who has been the author's companion in the field for many years.

We are told in the preface of this book that "each chapter represents a close and continued study with camera and note book at the home of some bird or group of birds—a true life history of each species." All who watch birds on this side of the Mississippi will be glad to see a faithful transcript of their manners on the Pacific slope, and should not be disappointed to find that their behavior is essentially the same wherever found.

The interests of the author seem to have centered in the acquisition of good photographic illustrations, and in this he has succeeded far better than most students who have gone into the field with such a purpose. Among the more noteworthy pictures may be mentioned some of the rufous humming-birds; the Maryland yellow-throat, a common but extremely shy species whose nest and eggs are rarely seen; the nest, eggs, and young of the red-tailed hawk, one of which shows the re-

mains of a big carp, the same fish which the author on that very day saw caught in a distant pond and carried by the old bird to its aerie; white-crowned sparrows; bluebirds perched on a line, and especially the picture of a young bluebird trying to seize food from its parent; warbling vireos feeding their young and standing at inspection, as well as some of the heron and eaglet pictures. Many which were taken on a five-by-seven plate have been trimmed rather too close in order to crowd them on the page, even to the clipping of a bird's wing or tail, or the scamping of its nest. Most of the illustrations are of immature birds or of adults bringing food to their young, whether in or out of the nest; nine only show the feeding process. There are no strictly serial pictures of either growth or activities, which approach biological completeness, in any of the species treated. The editor of a well-known magazine once rejected some pictures of little naked cedarbirds on the ground that they would be "positively objectionable" to a certain class of readers, and possibly the same class of readers would object to illustrations of serial activities. At all events, such pictures would add to the interest and value of any work, and would not injure its sale; so far as nest-life is concerned, they should include: the parent bringing in the food, the pause at the nest which calls forth the initial feeding reaction of the young, placing the food in the throat of the nestling, and watching for the response—which amounts to testing the throats of the young, and giving the food to those which can swallow it—standing at inspection, and cleaning the nest. When both birds come to the nest together they should be shown as a complete family group or unit. It may be added that such completeness should be aimed at, even if it can seldom be attained. Of the so-called "snapping" of isolated scenes in and about the nest a good deal has already been done, and in many cases to little purpose. The photographer should primarily be the student who aims to portray the whole behavior—the serial acts and attitudes of the adult and young. Whoever does this, even in the case of a few species, will make a most noteworthy contribution, whether from the popular or the scientific point of view.

Mr. Finley's twenty-one chapters deal successively with different families or species of birds, and he tells his story in a bright and entertaining manner. Aside from certain mannerisms, and the occasional tendency to pile up and mix his metaphors, the author writes well and effectively. In a single paragraph the rufous hummingbird is likened to "a flying fleck of a rainbow," a "flash from a whirling mirror," a "little shooting star . . . that hummed as well as glowed," to the "glint of real live sunshine," to "a minute ethereal sprite," and to "a mite that possesses the tiniest soul in feathers." In still another paragraph the hummer's flight is "like the rush of a rocket," "a red meteor," but "instead of striking with a burst of flying sparks, he veered just above the bushes with a sound like the lash of a whip drawn softly through the air." Again he "swung back and forth like a comet in his orbit." This puts an unfair strain on the reputation of so small a bird, and we should prefer to eliminate some of the "papas," "mamas," "babies," "bantlings," "marriages" and the like. The author is at his best in the chapters on the larger birds, the hawk, the owl, the crow, the heron and the eagle. These are all very interesting and abound in quotable passages.

Of the temper of the barn owlet he says: "Generally he sat with his chin resting on his chest like a broken-down lawyer. Once, when the photographer was least expecting it, he dropped on to his trousers leg as lightly as a feather, but with the strength and tenacity of a mad bull-pup. The claws sank through to the flesh, and before they could be pried loose they had drawn blood in three places." "In a Heron Village" this vivid picture is found: "When I first climbed in among the nests of a smaller tree with my camera, it sounded as if I were in the midst of a gigantic hen-house. Some of the birds were clucking over their eggs that were soon to be hatched; others were cackling over newly-laid eggs and squawking at being disturbed; others were wrangling and squabbling, so that there was a continual clattering fuss

above which one had to yell his loudest to be heard. . . . About me, seemingly almost within reach, I counted thirty-six sets of blue eggs. I was high above the tops of the alders and willows. Set all about below in the background of green were the platforms, each holding several eggs of blue. The trees were dotted in every direction. I counted over four hundred eggs in sight."

The most interesting observations recorded, from the standpoint of the reviewer, are the following: the young of the Vigor's wren were drawn or driven from the nest, when ready for flight, by the male, who would seize all the food which the female brought, until the young were forced to leave. The question of intelligence is not directly raised, but undoubtedly both birds were acting in this case from pure or nearly pure instinct, the female in hunting the prey, and the male in seizing it. We should expect to find intelligence developed in an equal degree in either sex. A bluebird box is mentioned in which one hundred and ten birds were hatched in eight years, and during one season there were three broods of 7, 7 and 5 birds, respectively. In one case, and this is a most interesting observation, two young bluebirds of the first brood followed the male about while the female was incubating her second litter. When the latter hatched the same young began to follow their mother, and they imitated her so well that they not only captured worms, but carried them to the box and fed their brothers and sisters of the second brood. It would be difficult to find a better example of imitation in young birds, having without doubt its base set firmly in instinct. But this suggestion is perhaps even more prosaic than that of the author, who surmises that "Perhaps the two birds of the first brood were girls, and took readily to housework." An oriole is mentioned which mated four times in succession before she was allowed to rear a family, the males having been successively shot by a collector. A western gull was seen to seize a clam, rise with it to a height of thirty feet and drop it on the hard ground. This act was repeated fifteen times before the bird was successful in breaking the shell and getting the soft meat. In parts of the old world gulls are said to resort to certain rocks for the purpose of breaking shellfish, which is by no means incredible. The act is intelligent, and is a good illustration of associative memory. The habit seems to be a rather rare and sporadic one.

In the nest of the golden eagle the author speaks of finding branches of green laurel, which were apparently renewed, when taken away. I have found freshly cut sprays of green hemlock in the nest of the red-tailed hawk, and fresh seaweed is said to be laid upon its mountain of a nest by the osprey. Herring gulls also add green materials to their nests from time to time. I have seen this gull while sitting on her eggs rise up, pull some fresh grass, tuck it under her body, and then settle back upon her eggs again. The "habit" is probably the same in every case, and may represent what I have called the "recrudescence of the building instinct." The fact that the leaf or the spray is fresh and green may attract undue attention.

The author remarks in his preface that "an important and sometimes difficult study of bird-life is to observe accurately and report without false interpretation the habits and actions of the birds." We should rather say that this was the whole matter, and sufficiently difficult at all times. Possibly in a popular work of this kind it would be hardly fair to hold the writer to the letter of his text. However, we note a few cases in which we can not agree with his statements or interpretations. Two paragraphs are devoted to the "heroic" act of a chickadee in clinging to her eggs when her home was invaded. It should be added that the nest-hole of the flicker can be sawn open and the broody bird lifted from her eggs or newly-hatched young with even greater ease and freedom, and all are familiar with the so-called "total depravity" of the setting hen. If we call the bird a hero in the first act, we must dub it a coward in the next, for when the flickers are a week old their parents have become excessively shy. In all such cases we have a common illustration of how

the instinct of fear is temporarily blocked or allayed by the stronger parental instinct, namely that of brooding the eggs or young.

The kingfisher's feet are said to be "deformed," and the author remarks: "I am sure a kingfisher would never pretend to walk." To be sure this bird is somewhat of a clodhopper, since he walks upon his whole foot, the proper attitude of a bear or man, and not simply on his toes like most birds, but even the young kingfishers are walkers and during the close of their subterranean life they learn the curious habit of walking backwards.

The paragraph on imitation (V. foot of p. 175) needs considerable revision. How can imitation be regarded as "the strongest factor in the life of the chick from the time it leaves the shell," if by "chick" "nestling" is meant, or how can "nest-building" be ascribed "largely to imitation," or "the lasting impressions in a bird's life" be formed "during the first few weeks of its existence"? Although singing is primarily due to instinct, it may be greatly modified through imitation, but nest-building in all its initial and important stages must be ascribed to instinct alone, and all the acts of young altricious birds show that they are quite incapable of any effective imitation whatever. As to intelligence, we may add that the first trace of it in the nestling is its learning "to know" its parents, in other words learning to limit its feeding reactions to those conditions which count, namely, to the presence or sounds of the old bird. In some cases such a power is partially acquired in two or three days. If young birds in the nest did really imitate so keenly, why do we not see the results of it in the European cuckoo and the cowbird; or must we regard them as bad children upon whom a good education is thrown away by their devoted foster-parents?

The polity of the gull community and nursery is not to be found in Mr. Finley's chapter on this bird, but the subject will repay the most careful study. Gull chicks are said to "show little fear," but we have found them very fearful after the fourth day, and from that time onward their fear seems to increase, unless brought up by hand. "Each mother" gull is said "to recognize her chicks largely by location." On the contrary, we have found by swapping chicks that they discriminate absolutely. One of the fiercest instincts of the herring gull is to defend its preserve and drive off intruders, and many stray and trespassing chicks are thus daily slaughtered in consequence.

Of a tame shrike that would come to call the author speaks in this wise: "His favorite perch was the back of a chair near the window, where he could look out over the slope, and here he would sit for an hour at a time, as if thinking. And how do we know but he was going over many of his hunts and hair-breadth escapes and thinking of the spring-time that was coming and the new experiences it would bring?" "I have often wished that I could fathom the thoughts that Jimmy had." This should be compared with a paragraph where the robin, certainly a bird of average intelligence, is dealt with: "I was standing in the back yard watching a robin that came for string to build her nest. I had wrapped a piece several times about a limb to see whether the bird would use any intelligence in unwinding it. I have always been sceptical of some of the stories that have been told of birds reasoning. For example, one writer tells of an oriole that took a piece of cloth and hung it on a thorn so the thread could be pulled out. When the cloth came loose, he said the bird refastened it. Again, he has the bird tying knots in the string to keep the ends from fraying in the wind, or tying the sticks together to make support for the nest. But these are not bird actions: they are evolved out of the fertile brain of the writer." We all recognize the "fertile brain" referred to, about which enough has been said, but if birds really have the power of abstract thought, and therefore of a high degree of intelligence, why should the fancies of the romancer be deemed impossible? What, indeed, are thoughts for—?

In spite of the criticisms of such matters as are here suggested the volume is a fresh contribution to popular ornithology, and is

both interesting and informing in an unusual degree.

Francis H. Herrick

SOCIETIES AND ACADEMIES

ORGANIZATION MEETING OF ILLINOIS STATE ACADEMY OF SCIENCE

More than one hundred persons gathered in the senate chamber at Springfield at ten o'clock Saturday morning, December 7, for the purpose of organizing a state academy. The meeting was called to order by A. R. Crook, curator of the State Museum, and U. S. Grant, Northwestern University, was elected chairman.

The opening address by Professor Chamberlin, on "The Advantages of a State Academy of Science" was given in the extemporaneous form and the following outline very imperfectly represents what was said.

Professor Chamberlin introduced his address by conveying the felicitations of the Chicago Academy of Sciences, and sketched some of the salient features of its history of a little more than fifty years, as a means of giving concrete illustration to some of the problems which the new academy must face. Special attention was directed to the radical change in the nature and relations of scientific activity since the oldest academies of the interior were established. In the pioneer days, an almost virgin field was open to naturalists, and enthusiasts in this field constituted the largest factor in the membership of its academies of science during their early stages of development. The results of these pioneer workers were much more fully within the appreciation of all their colleagues and of the intelligent public than are the products of the more highly specialized investigations of to-day. So widely has research deployed in the last fifty years, and so far has it reached into the more recondite phases of each field, that there is now far less community of interest and of intelligent appreciation, even among scientific workers themselves. This fundamental change brings new problems of organization and of adjustment. In like manner, the function of an academy as an avenue of publication has assumed a new aspect. Fifty years ago, an appropriate means of publication was one of the greatest needs which the academies supplied to the pioneer workers, for, aside from these academies, the available opportunities of giving publicity and permanence to scientific results were few and unsatisfactory. As the regional element was dominant in the results of the early naturalists, it was fitting that there should be a local means of publication. To-day, however, the results of research are, in general, more serviceable to scientific workers if they are gathered into the special journals devoted to the several departments of science. While the function of publishing the results of regional investigations still remains and may well continue to be subserved by the regional academies of science, and while certain adaptations of other results may serve an important regional purpose, the question whether an academy should endeavor to be the avenue of miscellaneous publication to the same extent as in the early days is one of the problems that invite the serious consideration of a new academy.

Attention was also directed to the problems presented by the geographic distribution of the centers of scientific activity within the state and by the not altogether felicitous relations of these centers to the capitol of Illinois.

The advantages of a state academy to those who are just entering upon scientific careers, to amateurs dissociated from institutions of research, to trained workers in relative isolation, and to workers in scientific centers, were specifically set forth. The values to be derived from opportunities of reading papers before fellow workers, of submitting results to discussion, of participating in the discussion of others' results, of extending scientific acquaintance, of cooperation, of mutual stimulus to endeavor, of personal education by contact with other workers, were dwelt upon in detail. The value of the academy as a means of disseminating the spirit, the method, and the love of science among the people of the state was especially emphasized. The func-

tion of advising relative to legislation on scientific matters was urged as highly important.

The address was closed by an earnest advocacy of the value of the spirit and method of science to the state and nation as an essential element in the solution of its great social, political, and ethical problems. The habit of conscientious search for the precise truth and the systematic control and guidance of opinion and action in accordance with the canons of scientific procedure were urged as means of supreme value in the elevation and purification of the common thought and feeling of our people. More than perhaps anything else, are the intellectual and moral methods of science a protection against current evils and a guarantee of safety in the future.

S. A. Forbes, University of Illinois, gave a history of the formation and existence of former state natural history societies. He called attention to the small number of scientific men in the state at the time when such organizations had their existence; pointed out the difference in present conditions; and showed the promise which there is of an important present and glowing future for the state organization. His address has been printed in SCIENCE.

The chair appointed as committee on organization: S. W. Williston, University of Chicago, Wm. A. Noyes, University of Illinois, and C. B. Atwell, Northwestern University. And these three selected to complete the committee of nine called for: T. C. Chamberlin, University of Chicago, S. A. Forbes, University of Illinois, A. R. Crook, State Museum, Fred L. Charles, State Normal School, H. V. Neal, Knox College, and B. B. James, James Millikin University.

At 2 P.M. the committee on organization reported with a constitution. The report was considered item by item and the constitution was adopted. The following officers were elected:

President—Professor T. C. Chamberlin, LL.D., University of Chicago.

Vice-President—Professor Henry Crew, Ph.D., Northwestern University.

Secretary—A. R. Crook, Ph.D., curator State Museum.

Treasurer—Professor J. C. Hessler, Ph.D., James Millikin University.

Dr. H. Foster Bain, state geologist, was appointed a member of publication committee.

The committee on membership consists of: Professor S. A. Forbes, LL.D., University of Illinois, Professor T. W. Galloway, James Millikin University, Professor J. P. Magnusson, Ph.D., Augustana College, Dr. C. H. Smith, Hyde Park High School, Chicago, and Professor B. B. James, James Millikin University.

After the organization was completed ten-minute addresses were given in a symposium on the outlook for young men in science. All of the speakers took an optimistic view of the situation.

W J McGee, as a guest of the occasion, represented the outlook in anthropology. The recognition and financial rewards to the worker in this branch are probably less than in many other branches of science, but the amount of work which remains to build the science into goodly proportions is great.

Dr. Coulter called attention to the many fields which are open to the worker in botany. Rewards are promised to the original worker, to the teacher and to men who would be satisfied with the less attractive, but none the less useful, work of cataloguing the flora of various regions.

Dr. Noyes finds the outlook for workers in chemistry not only attractive scientifically, but financially as well.

Dr. Bain considers the work of investigation and of practical application of geology to be in the main very alluring.

Dr. Crew pointed out the vast amount of investigational work which lies before the physicist, although any one who enters the door of pure physics will find written before the entrance "Leave behind the hope of wealth! All ye who enter here."

Dr. Neal read letters from various leaders in the teaching of zoology in many institutions, showing that the call for workers and investigators in zoology is great, and concluded that zoology offers a most attractive field for

men whose ambition is not wealth but a competence.

An informal dinner was enjoyed at six o'clock by about seventy-five persons.

In the evening to an audience of about six hundred, Dr. W J McGee gave his lecture on "Greater Steps in Human Progress."

His address combined in a rare degree such facts as would attract men of the highest scientific attainments and at the same time the more popular audience also. It might be expected that such a title, "Greater Steps in Human Progress," would imply consideration of the remarkable manufacturing and commercial advances which have characterized the last century.

His plan, however, was to note various habits and discoveries of men which indicate evolution from a low physical and mental equipment to the full expansion of man's faculties. Primitive men were unable to open the palm of the hand so as to bring the thumb in the same plane with the fingers. This was shown by the aboriginal Philippine tribes which Dr. McGee assembled at the St. Louis Exposition.

Primitive man is characterized by movements of the hand and arm *toward* the body, whereas his more highly developed descendant directs these movements *from* the body. It is the Anglo-Saxon who has shown this development in the highest degree, and while in other respects prize fighting is indicative of the lower traits, in this one fact, namely, that the motions of the arm in a well-directed blow are from the body of the fighter, the prize fighter's profession indicates high physical development—a real step in progress.

The savage grasps a knife with the blade held towards the body. Civilized man holds the blade from the body. The mistress wishing to judge the mental alertness of a prospective maid servant should hand her a plate and towel noting the motion of the hand as the maid wipes the plate. If the motion of the right hand is clock wise the maid should be considered a promising subject.

At some length Dr. McGee illustrated the fact that the development of "knife sense" is one of the greatest steps in human progress. Primitive men used a rounded stone and had no conception of the value of a sharp edge.

Another one of the great steps, and indeed the chief one, is in the use of fire. Man alone of all created things employs fire. It required long ages for men to learn the use of fire, and this discovery has made possible the great development of the human race, socially, commercially and intellectually.

Finally the faculty of invention is one which has contributed most forcibly and characterized most materially the development of the human race.

The interest which was displayed throughout the meeting, argues well for a successful and useful career for the society.

A. R. Crook,
Secretary

THE GEOLOGICAL SOCIETY OF WASHINGTON

The 195th meeting of the society was held on November 20, 1907, Vice-president Campbell in the chair and thirty-one members present.

Regular Program

The following papers were presented:

Report on the Geological Work of the Third Petroleum Congress: David T. Day.

The congress was called for September 8, in the city of Bucharest, Roumania, but the preceding days were also occupied in a geological excursion through the principal oil field—that of the Prahova Valley.

By means of a preparatory lecture by Professor L. Mrazek, director of the Geological Survey of Roumania, and by his continued guidance on the trip, a particularly good view was obtained of the complicated folding characteristic of the south flank of the Transylvanian Alps, where many well-marked anticlinals are evident, and along the axes of which the oil is chiefly sought (and found). The principal accumulations are closely associated with overthrust faults.

The congress visited principally the Bushtenari field, and had a good view of the geologic structure in passing from Bushtenari to Campina and to Moreni. In the latter field,

drilling is made particularly uncertain by a large body of rock salt which takes part in an over-thrust fault, the oil being found close to the under side of the salt. The oil is usually found under great pressure, and gushers are quite common. The oil is usually black, rather ethereal in its odor, and contains both paraffine and asphalt. In many cases, by natural diffusion the asphalt has been lost. The oil is then light in color, and in specific gravity. The oil carries a considerable proportion of members of the benzol series, which, of course, adds to the difficulty of refining.

The scientific work of the congress was divided into three sections—the first section being devoted to geology and oil exploration. Thirty-nine papers were presented in this section, of which twelve were descriptions of petroleum deposits, ten on theories of origin, ten on methods of drilling, and the remainder relating to oil-well management. H. Foster Bain, Ralph Arnold and A. F. Lucas contributed papers in regard to the Illinois, Santa Maria, California and Texas fields, respectively. Much attention was given to the discussion of structural details in the Roumanian fields.

A most important result was pointing out the evident importance of water in filling up the pores of the rock which form covers to the oil pools, and thus prevent the oil from escaping.

Mrazek's insistence on the function of water in driving by capillary action the oils from a diffused condition in shales, and compressing them in relatively small sands, was also of much importance for oil geology.

In regard to theories of origin, Professor Carl Engler replied to the criticisms which have been made against his theory on the animal origin of oil on account of the difference in optical activity between his oil prepared from fish, and natural oils, by showing that destructive distillation of cholesterine gives products similarly optically active to crude petroleum.

The Association of Alunite with Gold at Goldfield, Nevada: F. L. RANSOME.

The alternation of the andesitic and rhyolitic rocks of Goldfield which stands in closest relation to ore deposition has resulted in the removal of nearly all of their lime and magnesia, three fourths of their soda and two thirds of their potash. On the other hand water and sulphuric acid have been added and the iron of the original silicates has been converted to pyrite. The introduction of sulphuric acid is shown in the extensive development of alunite and some kaolinite and diaspore at the expense of the original feldspars.

The solutions which deposited the ores were acid and probably hot. They carried gold, copper, bismuth, antimony, a little arsenic, selenium and tellurium, hydrogen, sulphide, and probably sulphurous and sulphuric acids. Their solvent action on quartz was feeble.

The recognition of alunite as a characteristic constituent of the Goldfield ores and the demonstration of its genetic relation to them establishes a new type—that of alunitic and kaolinitic gold-quartz veins, in the classification of epigenetic deposits based upon the kind of metasomatism effected in the wall rock by the ore-depositing solutions. It is not believed that the Goldfield District is unique in the possession of this type. Other examples are likely to be found among the great number of ore deposits associated with Tertiary volcanism. The constituents removed from the Goldfield rocks are those which are deposited extensively in the production of gold-quartz veins of the sericitic and calcitic type. Consequently conditions are conceivable under which the acid solutions of Goldfield might have ascended through a much thicker series of rocks and given rise to sericitic and calcitic veins.

Finally, the relation of the alunite and kaolinite at Goldfield suggests the possibility of the future discovery of metasomatic veins of the pure alunitic type, without kaolinite.

The Place of the Great Raised Beaches in Geology: H. W. PEARSON.

Mr. Pearson gave the results he had reached in a study of the great raised beaches of Europe and America. Attention was called to the fact that up to the present time too little consideration had been given by geologists to

these terraces, which Mr. Pearson believed to be of marine origin. It was shown that if the elevations of beaches, as recorded by various writers who have studied these terraces, were plotted upon one diagram, and consideration given to the apparent difference in relative ages of their ordinates, we should find that,

1. These terraces resolve themselves into several distinct systems.

2. All these terraces are found with rising inclination to the *true north*—the most recent terraces, the upper member of which would have elevation if extended to the pole of about 1,467 feet, disappear, at the equator, into the present sea level. The older and more elevated terraces pass the equator at some considerable distance above the present sea level.

3. The upper terrace of the more recent series, corresponds with the upper surfaces of the so-called glacial lakes, Agassiz, Ohio, Warren, Algonquin, Iroquois, St. Lawrence, Gulf of Winnipeg, etc. It also corresponds with the upper surface of the Lafayette flood, and with the waters of the Champlain and Matanzas submergences. By this correspondence or absolute confluence in beach lines, it was held that complete demonstration was offered as to a similar confluence in all above-named water bodies.

4. The law of inclination found in these terraces is that the rising gradient especially of the younger terraces, increases to the north approximately as the sine of the latitude.

Mention was here made of some of the inferences that would properly follow in case the peculiarities in structure of beach lines as above noted, should be confirmed. For instance, a most logical decision would be that the extraordinary symmetry in these curves offered assurance that no motion of the earth's crust had taken place since the epoch of this elevated sea.

Another assumption might be made, as the mathematicians have shown its competency, that this northern flood may have been caused by a slight shifting of the earth's center of gravity under the effects of a polar ice cap.

Still another inference might be that the great ice dams urged in explanation of the raised beaches were no longer necessary.

The effect of the earth's rotation upon ocean currents was discussed and the matter of deformation of sea level by ocean currents mentioned and attention called to some of the perplexing differences in levels of confluent water bodies thus arising.

Ralph Arnold,
Secretary

THE BIOLOGICAL SOCIETY OF WASHINGTON

The 435th meeting was held December 14, 1907, President Stejneger in the chair.

Dr. M. X. Sullivan read a paper on "Toxic Bodies arising during Plant Metabolism," illustrating it with many photographs.

Many of the products of the life activity of plants have been tested as regards their toxicity to wheat and a number of these substances have been found toxic.

Wheat was grown successively in the same soil until the growth was poor. Investigation of the soil showed that toxic substances had been deposited therein during the growth of the plant. The absolute identity of the substances in plant and soil is yet to be ascertained.

Cowpea was grown in soil until the yield was slight. From this soil was obtained a crystalline body toxic to cowpea. To wheat in the same concentration the substance was beneficial.

The conclusion to be drawn from the paper is that the decrease in yield of plants grown successively on the same soil is due predominantly to substances arising in the metabolism of the plants and exuded from the seedling and roots.

Mr. A. H. Howell read some "Notes on the Migration of Bats," which will be published in the *Proceedings* of the society.

The 436th meeting was the 28th annual meeting for the election of officers. The following were elected for the ensuing year:

President—Leonard Stejneger.

Vice-presidents—T. S. Palmer, W. P. Hay, E. L. Greene, E. W. Nelson.

Recording Secretary—M. C. Marsh.

Corresponding Secretary—W. H. Osgood.

Treasurer—J. W. Gidley.

Councilors—A. D. Hopkins, J. N. Rose, A. K. Fisher, A. B. Baker, David White.

President Stejneger was nominated as a vice-president of the Washington Academy of Sciences.

M. C. MARSH,
Recording Secretary

THE AMERICAN CHEMICAL SOCIETY. NEW YORK SECTION

THE fourth regular meeting of the session of 1907–8 was held at the Chemists' Club, 108 West 55th Street, on January 10.

Dr. McMurtrie read a short obituary of the late Peter Townsend Austen who was closely identified with the section since its foundation. Dr. Austen served twice as chairman and contributed much to the society from his vast fund of information and experience in the field of chemistry.

Mr. T. J. Parker described the winter meeting in Chicago, speaking of the elaborate preparations made and the cordial reception extended to visiting chemists, of whom there was a good representation. Mr. Parker also spoke of the business transacted by the council, especially that relating to the publication of a journal of industrial chemistry. This journal together with those now issued would place the American Chemical Society ahead of any society of its kind in the extent of chemical knowledge recorded in its publications.

The following papers were read:

"Drop Weights and the Law of Tate. The Determination of the Molecular Weight in the Liquid State by the Aid of Drop Weights," by J. L. R. Morgan and Reston Stevenson.

"Note on the Precipitation of Zinc as Sulphide," by W. Geo. Waring.

C. M. JOYCE,
Secretary

DISCUSSION AND CORRESPONDENCE

BAPTANODON NOT A "TOOTHLESS" ICHTHYOSAUR

WHILE it may appear to be ungracious to point out the errors of others, especially of those who are valued scientific friends, nevertheless scientific accuracy and the truth of nature sometimes make it necessary to do so.

In the year 1880 Professor O. C. Marsh coined the word *Baptanodon* as the generic name of an ichthyosaurian which in the previous year he had designated as *Sauranodon*, which was preoccupied. Both names indicated the toothless character of the creature for which they stood, and Professor Marsh in his writings maintained the toothless character of *Baptanodon*.

In January, 1905, Dr. Henry Fairfield Osborn published an article in the *Century Magazine* upon ichthyosaurs, in which he speaks of the Jurassic ichthyosaurs included in the genus *Baptanodon* as "belonging to a race which, like certain of the whale tribe, lost their teeth because they had selected for food the softer marine organisms, such as the squids." Elsewhere he speaks of them as "toothless sea-robbers."

In hastily glancing over the pages of the second revised edition of Professor W. B. Scott's "Introduction to Geology," I discover on page 692 the following statement: "*Baptanodon*, found in Wyoming, is an ichthyosaur without teeth, and must have fed upon small and soft marine invertebrates, as do the toothless whales."

As both Professor Osborn and Professor Scott address themselves in their writings to large audiences, and their repetition of the error into which Professor Marsh fell, if backed by their great names, is likely to become very widely accepted, it seems proper for me to call the attention of men of science to the fact that in December, 1902, Mr. C. W. Gilmore in the columns of SCIENCE, N. S., Vol. XVI., pp. 913–914, called attention to the fact that *Baptanodon* was *not* a toothless reptile. Early in the spring of 1904 the Carnegie Museum published a Memoir by Mr. Gilmore entitled "The Osteology of *Baptanodon* Marsh," in which, at page 98, he shows that *Baptanodon*, like the English *Ophthalmosaurus*, is provided with teeth, and figured the teeth, and on page 121 he alludes to the fact that a tooth exists in the jaw of the type of the genus, No. 1,952, preserved in the collections of the Yale Museum, a fact which Professor Marsh had entirely overlooked.

Baptanodon is a misnomer, which, neverthe-

less, according to the laws of priority, must stand. The "toothless diver" of Marsh was *far from being toothless,* as is shown by the splendid material in the Carnegie Museum, as well as by Professor Marsh's own type specimen.

W. J. Holland

Carnegie Museum,
January 6, 1908

"TROTTING AND PACING, DOMINANT AND RECESSIVE?"

To the Editor of Science: I have noted with interest, in your issue for December 27, on page 908, the communication of Mr. W. Bateson, under the caption "Trotting and Pacing, Dominant and Recessive?" Regarding it I would beg to say that his informants who state that they have "never known a natural trotter produced by two natural pacers," while stating the results of their own experience, have, in that experience, missed, very evidently, a result that is not uncommon in the breeding of harness horses. I have personally known of numerous cases in which the produce from the mating of natural pacers has produced a natural trotter; and, as a matter of direct evidence, may cite a case which has very lately come under my notice.

One of the most celebrated pacing stallions of recent times is Direct Hal. He never lost a race and his record, 2.04¼, made in the first and only season (1902) that he was raced, has never been beaten by a stallion under the same conditions. Direct Hal was a natural pacer. His sire, Direct, was a natural trotter, and was first trained to trot, and given a record of 2.18¼ at that gait. He was then taught to pace and given a record of 2.05½ at that gait. He was himself a trotting-bred horse, but the majority of his get have been pacers. The dam of Direct Hal was Bessie Hal, a pacing mare, and pacing bred with the exception of a trotting cross on her dam's side.

One of the most celebrated pacing mares of recent times is Lady of the Manor. She won nearly all her races and also took a record of 2.04¼; which, when made (1899), was the fastest on record for a pacer of her sex. She was by Mambrino King, a trotting horse, with but a remote and attenuated pacing inheritance. Her dam was also a trotting mare, strongly trotting bred and with no near, or, supposedly, influential, pacing blood. Nevertheless, Lady of the Manor was a natural pacer. As she was bred to trot, she was first trained to trot; hobbles and heavy shoes and toe-weights being used to force her to adopt that gait, but the effort was unsuccessful. She was then allowed to pace, with the result above noticed.

After their retirement from racing, these two remarkable pacers were mated, and one of their produce, a filly, foaled in 1905, is now owned by a gentleman of my acquaintance, resident in this city, who has her in training at a farm near here. Both this gentleman and his trainer inform me that this filly is a square trotter, that has, since under their observation, never been seen to pace, either in or out of harness.

This is only one case of a number of similar ones that could be cited.

The whole question of the relation between the trot and the pace is a perplexing one. I have, I may say, devoted many years to its study, during which I have been afforded an embarrassment of riches so far as material for investigation was concerned. During this period I have at various times been of various opinions, which, for the time being, I have believed to be definitely established, but have again and again been unsettled as new evidence, not to be gainsaid, has presented itself. One thing is, however, incontestably true, viz., that pacers are much oftener produced by trotting parents, than trotters by pacing parents. Personally, I much doubt what Mr. Bateson says he has been given to understand —"that the distinction between the natural trotter and the natural pacer is so definite that doutbful cases are exceptional"—and consider the reverse to be, if anything, as probable.

John L. Hervey

INHERITANCE OF FLUCTUATING VARIATIONS

To the Editor of Science: Referring to Dr. Ortmann's interesting article in Science of November 29, I should like to ask him how he accounts for the well-known phenomenon of

correlation between parent and offspring in characters subject to normal, or "fluctuating," variation, if such variations are not in fact transmitted.

R. P. BIGELOW
MASSACHUSETTS INSTITUTE OF TECHNOLOGY,
BOSTON, MASS.

AGGREGATE MUTATION OF GOSSYPIUM

DR. O. F. COOK, in his official work for the U. S. Department of Agriculture, has observed several instances of abrupt change *en masse* of the distinguishing characters of varieties of cotton, full results of which he is preparing to publish. Some of those transmutations have occurred in connection with geographical transference, and some have not. Central American varieties on being brought to the United States have shown entirely distinct characters of habit and growth in all the plants from and after their first planting. In case of the well-known and long-cultivated upland cotton of the United States, he found all the individual plants of a whole planting to have become thus abruptly changed. The change involved the whole field crop of a planting, and the new crop differed equally from both the parent stock and the plantings of the same stock in other fields in the same season.

Dr. Cook properly regards these transmutations as identical in character with those which I have observed in the tomato and which in several publications I have designated as aggregate mutation. See especially *Popular Science Monthly*, Vol. LXVII., No. 2, June, 1905.

CHARLES A. WHITE

SPECIAL ARTICLES

THE CHROMOSOMES OF ŒNOTHERA

ON account of the general interest which attaches to this subject, it may be well to present some further facts, and also to review briefly our knowledge of the subject as developed up to the present time. The work is being continued upon a large amount of material collected during the summer from a culture which consisted of 1,700 pedigreed individuals, partly from pure races, and partly from guarded crosses. The collections made from each individual were kept separate from all others for examination. My work on the subject was begun on plants grown at Woods Hole, Mass., from seeds of DeVries, in 1905.

In December, 1906,[1] some of this work was reported upon. *O. lata* from a cross was found to have 14 chromosomes as sporophyte number, but quite unexpectedly one of the other plants from what was believed to be pure seeds of *O. lata* × *O. Lamarckiana* were found to contain 20 chromosomes. This result was published in a paper[2] on the abortive pollen development in *O. lata*, but it was discovered by the writer[3] a little later that *O. Lamarckiana* itself had 14 chromosomes. This result was afterwards confirmed by Miss Lutz,[4] and Geerts in a short paper[5] published the same result. After my first announcement of results Miss Lutz germinated seeds of several forms and examined the root-tips of the seedlings, finding[4] about 14 chromosomes in *O. Lamarckiana*, as already stated, but 28 or 29 in *O. gigas*.

I have since reported[6] 14 chromosomes in the *Lamarckiana* plants from *O. lata* × *O. Lamarckiana* as well as in the *O. lata* from this cross, also in *O. rubrinervis* and in *O. nanella;* together with various peculiarities of the reduction mitoses in the pollen mother cells of these forms. One of these interesting features is that sometimes in the heterotypic mitosis one chromosome passes to the wrong pole of the spindle, thus probably introducing

[1] American Association for the Advancement of Science, New York meeting.

[2] "Pollen Development in Hybrids of *Œnothera lata* × *O. Lamarckiana*, and its Relation to Mutation," *Bot. Gazette*, 43: 81–115, 1907.

[3] "Hybridization and Germ Cells of Œnothera Mutants," *Bot. Gazette*, 44: 1–21, 1907.

[4] "A Preliminary Note on the Chromosomes of *Œnothera Lamarckiana* and one of its Mutants, *O. gigas*," SCIENCE, N. S., 26: 151–152, August 2, 1907.

[5] "Über die Zahl der Chromosomen von *Œnothera Lamarckiana*," *Ber. deut. Bot. Gesells.*, 25: 191–195, 1907.

[6] International Zoological Congress, Boston, August 22, 1907.

an irregularity in the chromosome numbers of the next generation. This is especially common in the hybrids. An irregularity of this kind is probably the cause of the 15 chromosomes found by Miss Lutz[7] in one *O. lata* plant. Such irregularities will probably also explain other variations of one or two in the chromosome numbers, including the 20 instead of 21 chromosomes in what I have now shown to be an *O. lata* × *O. gigas* hybrid.

The long-believed tendency to wide variability in the number of chromosomes in root-tips made it important that the count made by Miss Lutz in *O. gigas* should be confirmed. I have recently examined the reduction mitoses in the pollen mother cells of *O. gigas* and also find the number to be 28, the reduced number being 14. The material for this study was obtained from A. C. Life, now of the University of Southern California. It was collected by him at Woods Hole, Mass., in the summer of 1905, from plants growing side by side with those from which my first material was collected.

I have also recently examined material from another plant in the cross which was believed to be pure *O. lata* × *O. Lamarckiana,* but which appeared to have all the characters of *O. gigas* and was found to have 21 chromosomes. This, with other evidence, furnishes definite proof that the cross which was believed to be pure had been partly pollinated with *O. gigas.* The interesting feature about this plant is the manner in which the chromosomes segregate in the heterotypic mitosis.

Almost invariably 10 chromosomes go to one pole of the spindle in the heterotypic mitosis in the pollen mother cell, and 11 chromosomes to the other pole. It is difficult to see how this can be interpreted in harmony with current views of the homology of maternal and paternal chromosomes. For even although we assume that in the reduction of chromosomes in the hybrid the descendants of the 7 *lata* chromosomes in the cross always pair with the descendants of 7 of the 14 *gigas* chromosomes, the remaining 7 *gigas* chromosomes are invariably distributed as though they paired with each other, with the exception, of course, of the unpaired chromosome which (when one is present) may go to either pole of the spindle according to chance. In other words, the chromosomes are invariably distributed as though 10 of them were homologous with the other 10, which is not the case when their origin is considered.

How the *O. lata* × *O. gigas* hybrid, which matures an abundance of pollen, will behave in later generations, is not known. A little thought will show that if the chromosomes always segregate in germ-cell formation in the manner described above, by crossing the hybrid with the parental types and judiciously re-crossing, in later generations plants may be obtained having all sporophyte numbers of chromosomes between 28 and 14, or reduced numbers between 14 and 7; and whenever the sporophyte number was an uneven one the plant would produce two kinds of germ cells, differing by one in their chromosome number. The writer hopes to carry some of these crosses forward in the future, as it is believed that they should throw light on the nature of a chromosome in its relation to somatic characters in heredity.

The early history of the bodies designated heterochromosomes is not yet fully worked out, but they are evidently not directly connected with the chromosomes, although frequently almost identical with them in appearance in the metaphase of the heterotypic mitosis. It is believed that these bodies will be found to be more nearly related to the ordinary nucleoli than to the chromosomes.

Resuming briefly, we may say that *O. Lamarckiana, rubrinervis, nanella,* as well as both the *lata* and *Lamarckiana* types arising from *O. lata* × *O. Lamarckiana,* have 14 chromosomes, with perhaps occasional departures of one from this number. *O. gigas* has 28 chromosomes, and certain plants appearing in the first hybrid generation of *O. lata* × *O. gigas* having almost or quite the identical appearance of *O. gigas* have 21 chromosomes (20 in one plant), the latter segregating equally in reduction, with the ex-

[7] International Zoological Congress, Boston, August 22, 1907.

ception of the unpaired chromosome, which passes to one pole of the spindle.

R. R. GATES

UNIVERSITY OF CHICAGO

CURRENT NOTES ON METEOROLOGY AND CLIMATOLOGY

CHANGES OF CLIMATE?

IN his recent volume (Vol. II.) on "Ancient Khotan," Dr. M. A. Stein, whose explorations in Chinese Turkestan are well known, points out that it requires constant and persistent effort to keep up the irrigation of the oases in that region. The wind-blown sand and the shifting courses of the silt-laden, snow-fed rivers are always tending to change the course and scope of the irrigation systems. If man relaxes his efforts in the least, the sand and the aridity of the desert replace the fertility of the formerly irrigated oasis. This has happened in many cases within human experience. A swing of the climatic pendulum in this region, towards a drier period, is not thought improbable, but the ordinary physiographic forces at work there are held sufficient to explain the changes of population and of settlements which have been clearly made out.

Again, in the Lake Chad district of Africa, Lieutenant Secker, in northern Nigeria, has lately reported that he found that the natives, by erecting fish-dams on the river Yo, are diverting water which would otherwise flow into the lake. These dams collect large masses of weeds, and lead to the formation of marshland. Lieutenant Secker is of the opinion that this may have something to do with the reported drying-up of Lake Chad.

FOG DENSITIES

The Quarterly Journal of the Royal Meteorological Society for October, 1907, contains a suggestion by J. A. Lovibond, "On a Method and Apparatus for Measuring Fog Densities." The method is based on the power of selective absorption of suitably colored glass. When this has been graded into mechanical scales of equivalent color value, a beam of white light can be progressively absorbed to extinction, and the luminous value of each successive absorption stated in quantitative terms. This analytical power also applies to the color constituents of the beam.

RAIN GAUGES

The Quarterly Journal of the Royal Meteorological Society for October, 1907, also contains a paper, by Dr. H. R. Mill, on "The Best Form of Rain Gauge, with Notes on Other Forms." Dr. Mill strongly recommends the "Snowdon pattern," which is 5 inches in diameter; has a vertical rim to the funnel of 4 inches, and has an inner can and also a bottle.

NOTE

The Annuaire Météorologique of the Royal Observatory of Belgium for 1907 contains a discussion, by A. Lancaster, entitled "L'Humidité de l'Air en Belgique," and an account of balloon ascents in Belgium by J. Vincent.

R. DEC. WARD

HARVARD UNIVERSITY

THE IOWA LABORATORIES OF ANIMAL BIOLOGY

AT the University of Iowa, new laboratories of animal biology have just been put into service under the directorship of Professor Gilbert L. Houser. These laboratories are located in a new and beautiful fire-proof building of thoroughly modern construction—the hall of natural science, erected by the state at an expense of three hundred thousand dollars. With the standard of their new quarters, the laboratories are entirely in keeping, so it is evident that the opening of these laboratories marks an epoch in the scientific facilities of Iowa.

The space devoted to animal biology comprises eleven rooms located in the north wing of the building on the second, the first, and the basement floors. This space is so unified, however, by a small elevator running through the rooms as to make the arrangement much more convenient than if all the space were on one floor.

The laboratories proper occupy the whole of the second floor of the north wing, the large

northern exposure giving excellent lighting. This space is chiefly devoted to two large laboratories—the introductory and the advanced, respectively. Each of these laboratories is forty-eight by fifty-three feet in size, and is lighted from three sides by nine very wide windows of plate glass. The heavily paneled ceiling is tinted pure white, and the paneling is supported by a row of beautiful scagliola columns running through the center of the laboratory. The side walls are tinted light buff.

The furniture is all of quartered oak, finished "Early English." Slate is used throughout for the tops of all laboratory tables. The tables assigned to students extend over sixteen feet into the room from the several windows, and their slate tops taper toward a narrow end away from the window, a device which permits each student to obtain unobstructed light for his work. These tables have a new and particularly successful form of electric microscope-lamp for every two students. Outlets for Bunsen burners comprise a part of the fixture at the base of each lamp. An abundance of individual drawer space is provided for each student. Microscope cabinets are ranged conveniently on the wall. And cabinet, drawer, microscope, lock, key—each is stamped with its own number.

The laboratory for introductory courses accommodates fifty-two students at one time; and the number of individual drawers permits the handling of two hundred and eight students in all. The advanced laboratory seats forty-four workers at one time, and the details of the tables here are especially adapted to such courses as require the extensive use of biological reagents. Each of these main laboratories has an adequate quota of general furniture designed for it, including cases for laboratory apparatus, a hood in the corner where reagents may be prepared without tainting the air of the room, and a large aquarium with an abundance of small jets of running water.

SCIENTIFIC NOTES AND NEWS

M. Henri Becquerel has been elected president of the Paris Academy of Sciences, and is succeeded in the vice-presidency by M. Bouchard.

Professor W. W. Campbell, director of the Lick Observatory, and his party have returned from Flint Island, having obtained excellent photographs of the recent total eclipse of the sun.

The Imperial Academy of Sciences of St. Petersburg has elected Professor Sir George Darwin, of Cambridge University, and Professor Charles R. Lanman, of Harvard University, to be corresponding members.

The German Chemical Society has elected as honorary members M. Becquerel, of Paris; Sir William Crookes, of London; Dr. C. von Linde, of Munich; Professor E. Solvay, of Brussels, and Professor J. Thomson, of Copenhagen.

At the general meeting of the Royal Meteorological Society, on January 15, M. Teisserenc de Bort, the distinguished French meteorologist, was presented with the Symons memorial gold medal of the society, and the president, Dr. H. R. Mill, delivered an address on "Map Studies of Rainfall."

M. Baillaud, of the Toulouse Observatory, has been appointed director of the Paris Observatory.

C. E. Moss, D.Sc. (Victoria University), has been appointed curator of the herbarium of Cambridge University.

Dr. William F. M. Goss will be installed as dean of the College of Engineering of the University of Illinois on February 25. In the morning there will be addresses by the president of the university, by representatives of the trustees, of the alumni and of the faculty; followed by the installation address of Dean Goss. In the afternoon there is an inspection of equipment, followed by addresses of visiting engineers. These exercises are to be in connection with the formal opening of the graduate school, which occurs on February 4 and 5.

A dinner in honor of Dr. Rudolf Leonhard, Kaiser Wilhelm professor at Columbia University this year, and Dr. John W. Burgess, Theodore Roosevelt professor at Berlin last

year, was given at the Hotel Astor on January 28.

THE chiefs of the Six Nations in New York, through the Onondaga tribe, which has been the keeper of the archives throughout the history of the Iroquois Confederacy, have conferred on Director John M. Clarke, of the New York State Museum, the title of Hossan-na-ga-da, the Keeper of the Name, in recognition of his official custodianship of the Iroquois wampums which were transferred to the state in 1898. The title is to be transmitted in perpetuity with the directorship of the State Museum.

GOVERNOR DENEEN, of Illinois, has appointed the following commission, authorized by the general assembly to investigate the diseases of occupation in the state and report to the next general assembly: Dr. L. Hektoen, of Chicago; Dr. Alice Hamilton, of Hull House, Chicago; Dr. George W. Webster, of Chicago, president of the State Board of Health, and the secretary of the State Board of Health, Dr. James A. Egan.

THE occupation of the Smithsonian seat in the Naples Zoological Station has been approved in behalf of Mr. I. F. Lewis for the month of March of the present year. Mr. Lewis is Bruce fellow in biology at Johns Hopkins University. The seat has further been assigned to Dr. F. M. Andrews, associate professor in botany at the Indiana University, for April and May. Dr. Andrews is now doing research work with Professor Pfeffer at Leipzig, and will devote himself to a problem in plant physiology while at Naples.

MR. ROBERT B. MARSHALL, of the United States Geological Survey, has been appointed to administrative charge of the Topographic Branch of the Survey with the title of chief geographer. Mr. Marshall received his first appointment in the Survey in 1890, and has been connected with it continuously since that date. In 1903 he was given charge of California work, and two years later his district was enlarged to include Oregon. In the reorganization of the Topographic Branch in March, 1907, he was made geographer in charge of the Pacific Division, which comprises California, Oregon, Idaho, Nevada, Utah and Arizona. Mr. Thomas G. Gerdine, who has for a number of years had general supervision of the topographic work in Alaska, has been placed in charge of the Pacific division to succeed Mr. Marshall.

PROFESSOR ALBERT NEISSER has returned to his post in Breslau after his long stay at Batavia for research on syphilis in monkeys. He will deliver an address on the present status of the pathology and treatment of syphilis at the approaching German Congress of Internal Medicine at Vienna, opening on April 6.

DURING the week from January 13 to January 18, Dr. Herman von Schrenk, consulting timber engineer for the Atchison, Topeka and Santa Fé Railroad and supervisor of timber preservation for the Chicago, Rock Island and Pacific Railroad, gave, as in former years, a course of seven lectures at the Forest School of Yale University on the decay of timber and a description of American and European methods and plants for seasoning and preserving wood.

WILLIAM S. BIGELOW, A.B. (Harvard '71), M.D. '74, of Boston, has been appointed Ingersoll lecturer for this year at Harvard University. His subject will be "Immortality as conceived and taught in Buddhism." The date of the lecture has not yet been fixed.

PROFESSOR PAUL H. HANUS, of Harvard University, addressed the Civic Federation of New England, in Boston, on January 9, on "Industrial Education under State Auspices in Massachusetts."

PROFESSOF LEO LOEB, of the laboratory of experimental pathology, University of Pennsylvania, read a paper on "Tissue Growth and Tumor Growth" at a meeting of the American Philosophical Society on January 17.

AT the meeting of the Academy of Natural Sciences of Philadelphia, held January 21, Dr. Casey A. Wood, of Chicago, gave the results of his ophthalmoscopic examination of the eyes of birds. The communication was illustrated by beautiful colored lantern views

of the arrangement of nerves and blood vessels of the interior of the eyes of birds correlated in a most interesting way with the habits of the several species studied by the speaker in London and elsewhere.

THE Royal Institution celebrated on January 17 the centenary of the discovery of the metals of the alkalis by Sir Humphry Davy. An address on this subject was made by Professor T. E. Thorpe.

A MEETING in commemoration of the life and work of Lord Kelvin was held by the Philosophical Society, of Washington, at the Hubbard Memorial Hall, on January 18. Addresses were made by Professor Arthur G. Webster, Dr. Robert S. Woodward and Professor Simon Newcomb. Ambassador Brice likewise made some remarks. Dr. L. A. Bauer presided.

THE twenty-fifth anniversary of the death of the Russian surgeon Pirogoff has been celebrated by conferring his name on a street and hospital at St. Petersburg and endowing an annual prize for works on surgery. Moscow has also named a street and a hospital in his honor and founded a Pirogoff prize.

MR. MORRIS K. JESUP, president of the American Museum of Natural History and of the Chamber of Commerce of New York City, has died at the age of seventy-seven years.

DR. JOHN ORDRONAUX, lecturer on medical jurisprudence at Columbia University from 1861 to 1897 and the author of numerous works on medical jurisprudence, has died at his home at Glenhead, L. I., at the age of seventy-seven years.

DR. THOMAS FILLEBROWN, for many years professor of operative dentistry and oral surgery at the Harvard Dental School, died on January 22, at the age of seventy-one years.

THE death is announced of Lieutenant Colonel R. J. L. Ellery, professor of astronomy and late director of the Melbourne Observatory, at the age of eighty years.

THE Rev. Lorimer Fison, known for his researches among the aborigines of Australia, died near Melbourne on October 29 at the age of seventy-five years.

DR. ZULKOWSKI, professor of applied chemistry in the German Technical School at Prague, has died at the age of seventy-four years.

SECRETARY ROOT has urged upon congress an appropriation of $50,000 to enable the government of the United States to be represented in the exposition to be opened at Quito on August 10 next, to celebrate the one hundredth anniversary of the independence of Ecuador.

THE State Charities Aid Association has received $10,000 from the Russell Sage foundation to organize methods for the prevention of tuberculosis throughout the state of New York.

A JOINT meeting of the Wisconsin Academy of Sciences, Arts and Letters, the Wisconsin Archeological Society, the Wisconsin Mycological Society, the Wisconsin Natural History Society and the Wisconsin section of the American Chemical Society will be held in Milwaukee—probably in the lecture room of the Public Museum—on Thursday and Friday, February 13 and 14. The plans at present formulated include a session on Thursday evening to which the public will be invited, the program for which will be of general interest. A banquet for the members of all the societies will be held on Friday evening.

AN Italian Society for the Study of Tropical Diseases has been founded on the initiative of Professor Angelo Cello, director of the Institute of Hygiene of Rome, Surgeon-Lieutenant-Colonel L. T. Cipollone, of the Italian Navy, and Surgeon-Captain G. Memmo, of the Italian Army.

OWING to the success achieved in the execution of the magnetic survey of the Pacific Ocean, under the auspices of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, it is proposed upon the return of the present vessel (the *Galilee*), to San Francisco next May, to return her to the owners and to undertake the construction

of a vessel especially designed and adapted for magnetic work. Such a vessel, it is said, will not only greatly facilitate the observational work by getting rid of the troublesome deviation corrections but will likewise materially reduce the office computations. As soon as this vessel is completed similar work to that of the Pacific Ocean is to be undertaken in the other oceans. With the aid of such a specially adapted vessel and the cooperation already secured by the Department of Terrestrial Magnetism from various countries, it seems reasonably sure now that a general magnetic survey of the globe will be completed within a period of ten to fifteen years.

NUMBER 6 of the Augustana Library Publications has just been issued by Augustana College at Rock Island. It is a Linné Memorial number and the principal paper is by Dr. P. A. Rydberg, curator of the New York Botanical Garden, and is on the subject "Scandinavians who have contributed to the knowledge of the Flora of North America." The author says that his national pride helped him in choosing his subject, and well he might, for on the forty-nine pages of his paper he gives biographical and bibliographical notes on no less than 101 Scandinavian scientists who have contributed to the knowledge of systematic botany of North America, including Greenland, Mexico, the West Indies and Central America. The lists of the writings by the various authors contain 280 titles. One of these works, "Peter Kalm's Travels in North America," is in three volumes and is generally known as one of the best accounts of this country in the early days, and has been published in three languages. In all his writings, the author states, Linné described no less than 2,000 American species of plants. Of Scandinavian American botanists, who are now, or who have been residents in this country, the author enumerates no less than twenty-eight, himself being one of the number. Apparently he is easily foremost, as it appears from the long list of his own papers which has been inserted without the author's intention by the editor. Altogether the paper is a worthy memorial of the two hundredth anniversary of the birth of the illustrious Swede whose life's work gave the first great and world-wide impetus to the study of systematic natural history, and it is particularly fitting that such a memorial paper should be issued by an institution that has been reared by the descendants of the great botanist's countrymen in America.

MR. H. M. TAYLOR, formerly tutor of Trinity College and mayor of Cambridge, is trying to promote the provision of scientific books for the blind. He has made a statement in which he says: "The blind who are interested in subjects of a scientific character are very heavily handicapped. An embossed copy of any book occupies a very much larger space than a printed copy of the same book. Lately the British and Foreign Blind Association has published Mr. Charles Smith's 'Elementary Algebra,' the published price of which is 3s. 6d. The embossed edition consists of five 'large royal quarto' volumes, containing in the whole 800 pages. The published price in cloth is 16s. 6d. Books in embossed type are very much needed, I am told, on such subjects as mechanics, physics, astronomy, chemistry, and geology. I hope that I shall not be disappointed in my belief that there are many persons interested in science who would be willing to contribute to a fund which would enable books on such subjects as I have mentioned to be embossed for the use of the blind, and to be sold at a more moderate price."

THE Exhibition Committee announces that the Grand Exhibition of Japan will be opened in Tokio on April 1, 1912, and will be closed on October 31 of that year. It will be held on a site covering about 292 acres. All foreign governments and peoples are invited to participate in this exhibition. For foreign exhibits belonging to the five different departments of education, science, machinery, electricity, and manufactured goods, space will be allotted in the exhibition buildings erected by the administration office of the Grand Exhibition of Japan. For exhibits other than those above designated, any nation may erect

a separate building at its own expense, which it may also use, if it pleases, for the articles belonging to the five departments mentioned. No charge will be made for space allotted for such building. All articles which shall be imported from foreign countries for the sole purpose of exhibition, and not used for commercial purposes in the country, and all materials for the buildings of foreign governments, or special exhibition buildings and decorations thereof, will be admitted free of duty. It is proposed to make a special arrangement concerning articles which shall be imported from foreign countries for sale at bazaars, or things intended for amusement and shows which are liable to customs duty, and a bill to that effect will be introduced in the next session of the diet. It is also intended to afford special protection to all inventions, designs, models of utility, and trade marks of foreign exhibits, and a bill to that effect will be introduced in the next session of the diet.

UNIVERSITY AND EDUCATIONAL NEWS

According to the daily papers the will of the late Mrs. Lydia Bradley disposes of an estate valued at $3,000,000. Almost the entire property goes to the Bradley Polytechnic of Peoria, Ill., which she established. Mrs. Bradley left only $5,000 to be divided among the children of her brothers and sisters, who, it is said, will institute suit to annul the will.

The Rev. Dr. Henry M. Sanders, who, in 1901, retired from the pastorate of the Madison Avenue Baptist Church, New York, has given $75,000 to Vassar College for the erection of a chemical laboratory. Plans for the building have been accepted, and construction will begin next month. The laboratory is to be of brick with terra cotta facings and in accord with the other buildings of the college. It will be 130×60 feet.

Mr. Andrew Carnegie has given $200,000 to Berea College, subject to an equal amount being given by others. It will be remembered that the Kentucky legislature required the separation of white and colored students, and Berea College has undertaken to establish and maintain two institutions.

Mr. Carnegie, who recently gave $50,000 to Illinois College, at Jacksonville, after $100,000 had been raised as a condition, has now consented to give a further sum of $75,000 on condition that an equal sum be raised.

According to the report of the treasurer of Princeton University, the university received during the last academic year gifts and bequests of the value of nearly a million dollars. This included $200,000 from an anonymous donor towards the biological laboratory, and $116,000, received through the committee of fifty for general purposes.

The trustees of the Western University of Pennsylvania have purchased for $68,000 twelve acres of the Schenley farms property, near the Carnegie Institute and Carnegie Technical Schools, Pittsburg. Plans will be secured for the new buildings, which, when completed, will cost over $1,000,000.

The legislature of Wisconsin has appropriated $30,000 for the establishment of a mining school at Platteville, which is in the zinc and lead mining district of the state.

Former Judge George G. Reynolds, of Brooklyn, has established two scholarships at Wesleyan University, Middletown, Conn., from which he was graduated in 1841. Twenty-five hundred dollars are provided for each.

Mr. H. O. Wills has promised £100,000 towards the endowment of the University for Bristol and the West of England provided a charter be granted within two years.

From the estate of Richard Brown, Youngstown, Ohio, Mount Union College, Alliance, Ohio, has received $30,000 for the endowment of a professorship. The board of trustees at their last meeting, in accordance with the provisions of the bequest, installed such professorship, and named it the Richard Brown professorship of mathematics. Professor Benjamin Franklin Yanney, head of the department of mathematics of the institution since 1894, was elected to the professorship.